MODEL 2763 SERIES

DP/MF/DTMF SIGNALING DISPLAYS INSTALLATION AND OPERATION

Northeast Electronics Instruction Manual

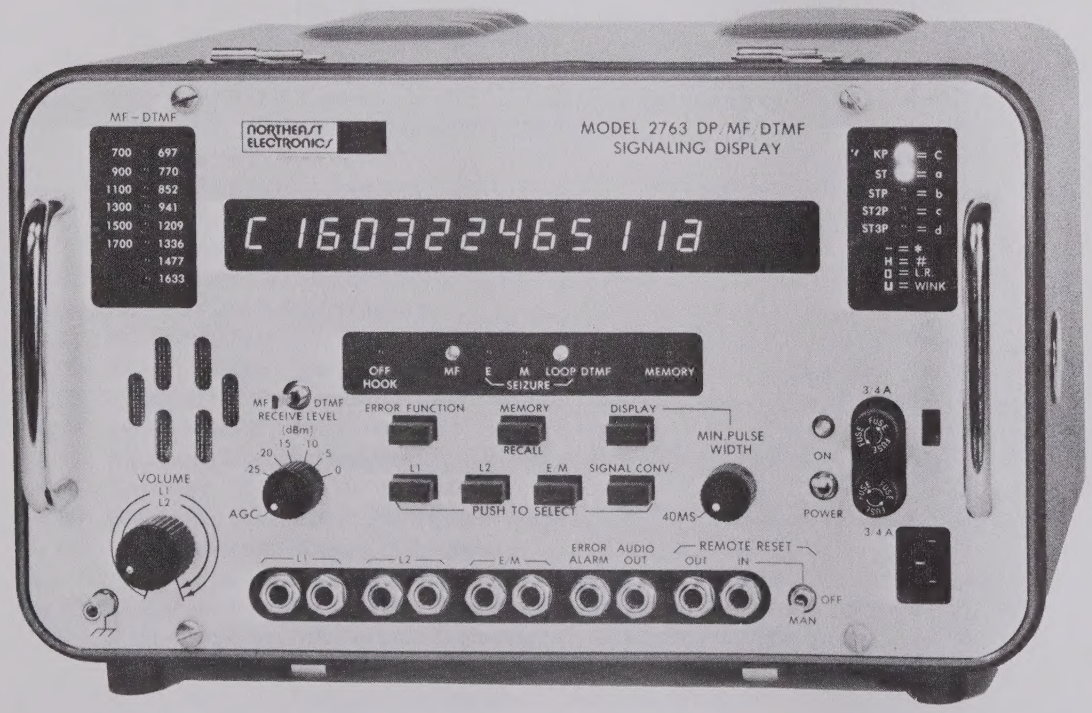
A2763-00-600 Issue 3 June 1982

northeast electronics
DIVISION OF tau-tron inc.
A UNIT OF GENERAL SIGNAL

MODEL 2763 SERIES

DP/MF/DTMF SIGNALING DISPLAYS

INSTALLATION AND OPERATION



northeast electronics
DIVISION OF tau-tron inc.
A UNIT OF GENERAL SIGNAL

TABLE OF CONTENTS

SECTION	TITLE	PAGE
1	**INTRODUCTION**	1–1
	1.2 General Description	1–1
2	**SPECIFICATIONS**	2–1
3	**INSTALLATION**	3–1
	3.2 Initial Inspection	3–1
	3.4 Service Information	3–1
	3.9 Installing Portable Models 2763/2763A DP/MF/DTMF Signaling Displays	3–1
	3.11 Installing Rack-Mount Model 2763R DP/MF/DTMF Signaling Display	3–1
	3.17 E&M Internal Switch Settings	3–2
	3.19 PC Board Access in Model 2763/2763A	3–2
	3.21 PC Board Access in Model 2763R	3–2
4	**OPERATION**	4–1
	4.2 Differences Between the Portable Model 2763/2763A and Rack-Mount Model 2763R	4–1
	4.4 Controls, Indicators, and Connectors	4–1
	4.6 Test Set Power Up Sequence	4–1
	4.7 Sequential Call Monitoring Control Settings	4–8
	4.9 Signaling Converter Monitoring Control Settings	4–10
	4.12 Display Symbols	4–11
	4.14 Displays and User Memory	4–11
	4.19 MF/DTMF Frequency Display	4–11
	4.21 KP and ST Display	4–12
	4.23 Seizure and Signaling Mode Display	4–12
	4.28 Operating Controls	4–13
	4.29 MF/DTMF Control	4–13
	4.31 Minimum Pulse Width (MPW) Control	4–13
	4.36 Receive Level Control	4–13
	4.38 Signal Conv. Control	4–13
	4.43 Error Function Control	4–14
	4.49 Reset Control	4–14
	4.52 Displays and Call Sequences	4–14
	4.54 Notes on Dial Pulse Operation	4–14
	4.61 Notes on DTMF Operation with Error Function Disabled	4–29
	4.65 Notes on DTMF Operation with Error Function Enabled	4–29
	4.69 Notes on MF Operation with Error Function Disabled	4–29
	4.74 Notes on MF Operation with Error Function Enabled	4–29
	4.77 Backward Signaling and Display	4–30
	4.82 Operation Under Abnormal Conditions	4–30
	4.86 Diagnostic Operation in Dial Pulse Systems	4–30
	4.89 Detecting Missing Dial Pulses	4–34
	4.93 Detecting Short Dial Pulses	4–34
	4.101 Diagnostic Operation in Tone MF Signaling Systems	4–35
	4.103 Detecting Deficient MF Signaling . . . The Error Function	4–35
	4.108 Example of Error Analysis	4–35
	4.111 Detecting Excessive Differences in Transmission Levels	4–36
	4.116 Detecting Short MF Pulses (Machine Sent)	4–37/4–38

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE
3–1	Model 2763R Installation Diagram	3–3
3–2	Interconnection Data for Model 2763/2763A/2763R Signaling Display with Model 2776 Trunk Access Unit	3–4
3–3	Interconnection Data for Model 2763R Signaling Display with Model 2776 Trunk Access Unit and Model 2765A Call Disposition Analyzer	3–5
3–4	Front Panel to Rear Barrier Strip Interconnection	3–6
3–5	Pin-Out for External Equipment Data Bus Connector Jack (Model 2763R)	3–7
3–6	Internal Switch Locations	3–8
4–1	Model 2763/2763A Controls, Indicators, and Connectors	4–2
4–2	Model 2763R Front Panel Controls, Indicators, and Connectors	4–3
4–3	Model 2763R Rear Panel Connectors	4–3
4–4	DTMF Call with Loop Supervision	4–15
4–5	MF Call with Loop Supervision	4–15
4–6	MF Call with E&M Supervision (M-Lead Seizure)	4–16
4–7	MF Call with E&M Supervision (E-Lead Seizure)	4–16
4–8	DP-MF Cama Call with Loop Supervision	4–17
4–9	DP-MF Cama Call with Loop Supervision	4–18
4–10	DP-MF Cama Call with E&M Supervision (E-Lead Seizure)	4–19
4–11	DP-MF Cama Call with E&M Supervision (E-Lead Seizure)	4–20
4–12	DP-MF Cama Call with E&M Supervision (M-Lead Seizure)	4–21
4–13	DP-MF Cama Call with E&M Supervision (M-Lead Seizure)	4–22
4–14	MF-MF Cama Call with Loop Supervision	4–23
4–15	MF-MF Cama Call with Loop Supervision	4–24
4–16	MF-MF Cama Call with E&M Supervision (E-Lead Seizure)	4–25
4–17	MF-MF Cama Call with E&M Supervision (E-Lead Seizure)	4–26
4–18	MF-MF Cama Call with E&M Supervision (M-Lead Seizure)	4–27
4–19	MF-MF Cama Call with E&M Supervision (M-Lead Seizure)	4–28
4–20	Displays for Backward Signaling on E&M	4–31

LIST OF TABLES

TABLE	TITLE	PAGE
2–1	Models 2763, 2763A, and 2763R Specifications	2–1
3–1	External Equipment Data Bus Signals (Model 2763R)	3–7
3–2	E&M Internal Switch Settings	3–8
4–1	Controls, Indicators, and Connectors	4–4
4–2	Control Settings and Patching for Sequential Call Monitoring	4–9
4–3	Control Settings and Patching for Signaling Converter Monitoring	4–10
4–4	MF Number and Code Tone Pairs	4–11
4–5	DTMF Tone Pairs	4–11
4–6	Use of Codes 11 Through 15 by Various Signaling Systems	4–12
4–7	MF Signaling in Coin Control	4–12
4–8	Monitored Signaling Per Call	4–13
4–9	Data Transfer and Non-Monitor Conditions	4–33
4–10	MF Signaling Requirements	4–36

SECTION 1

INTRODUCTION

1.1 This manual describes the Northeast Electronics 2763 Series DP/MF/DTMF Signaling Displays consisting of two portable models and a rack-mount model. The portable versions, Model 2763 (part number 2763-00-900) and Model 2763A (part number 2763-02-900), are the same except that Model 2763A does not monitor DTMF signaling. Model 2763R (part number 2763-03-900) is a rack-mount version of the Model 2763, and is provisioned with rear panel connectors not found on the portable units. Except for these differences, specifications and operational instructions presented in this manual are relevant to the three model versions of the 2763 series. Specifically for the Model 2763A DP/MF Signaling Display, disregard DTMF specifications and monitoring procedures, and ensure that its MF/DTMF toggle switch is set at MF when monitoring MF signaling.

1.2 GENERAL DESCRIPTION

1.3 The 2763 Series Signaling Displays permit comprehensive monitoring of signaling and supervision information present on in-service telephone circuits.

- ☐ Displays and analyzes DP, DTMF, and MF (CCITT #5 or R1 type) signaling.
- ☐ Detects and displays loop and E&M supervision . . . including wink, delay dial, answer, and CAMA ANI start dial.
- ☐ The display, together with a memory, provides flexibility for various testing conditions. . . a single call, two sequential calls, a CAMA call, and DTMF to DP, DP to MF, and MF to DP converters.
- ☐ Has built-in error detection and diagnostic features.
- ☐ Can be used for both signaling/supervision testing and service observation.

1.4 The 2763 has high impedance inputs for bridging on either a 2-wire, 4-wire, or 6-wire circuit. It automatically captures up to 32 signaling events at a time for selected viewing on a 16-character display. Recognized events include DP, DTMF, and MF digits and codes, plus several supervisory conditions.

1.5 Both loop and E&M (Types I, II, and III) supervised circuits are handled. The displayed supervisory events are: on-/off-hook status, wink, delay dial, answer, and CAMA ANI or TSPS start-dialing signals.

1.6 A flexible display/memory arrangement permits capturing data for reviewing the following:

- ☐ up to 32 signaling events for a single call;
- ☐ both the called party and calling party numbers for a single CAMA call, up to 16 events each;
- ☐ digits, codes for two calls in sequence, up to 16 events each; and
- ☐ both input and output sequences when testing signaling converters, up to 16 events each.

1.7 When enabled, the 2763 checks for several error conditions to aid in diagnosing signaling problems. Error conditions include:

- ☐ MF signals not composed of two and only two tones;
- ☐ DTMF signals composed of one tone only;
- ☐ MF signals comprised of two tones, one arriving more than 6 milliseconds after the other (skew error); and
- ☐ DP digits consisting of more than 16 pulses.

1.8 With the error function enabled, an "E" inserted in the dialing digits display at the appropriate location indicates a detected error. Also, alarm contacts close to initiate an external alarm. LED panel indicators show the actual tone or tones received for an invalid MF signal not composed of two and only two tones.

1.9 Panel controls provide trouble detection and diagnosis capabilities. The test set can check received dial pulses or tone pairs for correct minimum pulse width. This permits identifying problems caused by short pulse or erratic senders, faulty repeating relays, slow echo suppressors, and similar sources.

1.10 A 2763 permits user selection of automatic or manual received signal gain control. The AGC mode provides a 38-dB input dynamic range and accepts MF signals with a twist of 6 dB.

1.11 The manual gain control establishes an absolute level above which a tone in an MF signal must exceed to be detected regardless of twist. When used with the error function, it allows identification of signaling problems stemming from marginal sender output level, faulty transmission, and similar conditions.

1.12 For service observation applications, a 2763 may be used by itself to monitor circuits on an individual "jack-in" basis. Or, the test set, together with up to three Model 2776 Trunk Access Units, operates as a fully automatic new-call searching system on up to 90 circuits. (See Figure 3—4). In addition, a Model 2765A Call Disposition Analyzer automates the entire service observation and data recording process of the Model 2763R (see Figure 3—5).

1.13 The Models 2763 and 2763R operate identically. The 2763 is a portable unit while the 2763R is a rack-mounted unit. Both units are functionally the same. The only electrical differences are that:

1. the power input jack appears on the front panel of the 2763, and appears on the rear panel of the 2763R,

2. an accessory output connector is found at the rear panel of the 2763R, and

3. The 2763R has a barrier strip with contacts connected in parallel with front panel input/output jacks.

SECTION 2

SPECIFICATIONS

2.1 The specifications of the Model 2763, 2763A, and 2763R DP/MF/DTMF Signaling Displays are listed in Table 2–1.

Table 2–1. Models 2763, 2763A, and 2763R Specifications.

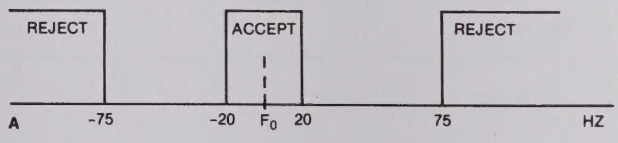
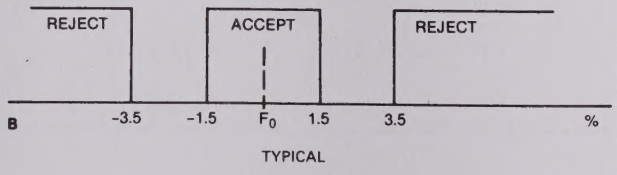
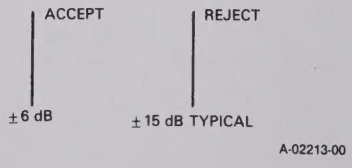
TONE RECEIVER (MF/DTMF)	
SENSITIVITY(dBm into 600 ohms)	
AGC: (Range)	– 26 dBm min. (– 30 dBm typical) + 2 dBm max. (+ 8 dBm typical)
Adjustable: (Range)	– 26 dBm min (– 30 dBm typical) + 2 dBm max. (+ 4 dBm typical)
INPUT IMPEDANCE (L1 & L2)	
Tip to ring:	20 kΩ (200 to 3500 Hz) dc blocked to 100 V
DC INPUT ISOLATION	
Tip to ground, ring to ground:	200 kΩ
FREQUENCY RESPONSE	
MF filter bandwidth:	
DTMF filter bandwidth:	
TWIST (MF/DTMF)	
(Twist = level difference of the tones in a compound signal . . . high frequency level with respect to low frequency level.)	
Compound level – 20 to + 2 dBm: (MF: F1 and F2 ± 1% of nominal frequency) (DTMF: F1 and F2 ± 1.5% of nominal frequency)	
ACCURACY OF RECEIVE LEVEL CONTROL: (F1 and F2 at nominal frequency)	± 2 dB typical
ACCURACY OF MIN. PULSE WIDTH	
MF:	± 10 msec
Tone ON: 20 msec to 99 msec	± 5 msec typical with twist ± 1 dB

Table 2—1. (Cont'd.)

TONE RECEIVER (MF/DTMF) cont'd.	
MF (Cont'd.):	
Tone OFF: ≥20 msec (Input level of each frequency component 10 dB or more above RECEIVE LEVEL control setting with no frequency deviation.)	±7 msec typical with twist = ± 6 dB
DTMF:	± 10 msec
Tone ON: 25 msec to 99 msec	± 5 msec typical with twist < ± 1 dB
Tone OFF: ≥25 msec (Input level of each frequency component 10 dB or more above RECEIVE LEVEL control setting with no frequency deviation.)	± 7 msec typical with twist = ± 6 dB
SKEW (MF) ERROR DETECTION: (ERROR FUNCTION enabled)	8 ± 2 msec typical
BALANCE:	Balanced input per PUB 41009
OPTIMUM TALK OFF PROTECTION (DTMF)	RECEIVE LEVEL control set at: 1. AGC or 2. at less than 6 dB below input signal.
DIAL PULSE RECEIVER (LOOP)	
SENSITIVITY (DC)	
On hook:	Tip and/or ring more positive than − 4 V or open circuit.
Off hook:	Tip and ring more negative than − 6 V for more than 10 msec.
	NOTE Off-hook threshold adjustable from − 2 V to − 24 V. Factory set at − 5.5 V with reference to ground. Typical maximum loop resistance allowable for good operation with factory setting with less than 20 Vrms, 60-Hz longitudinal FEMF.
	CO BATT (Volts) / MAX LOOP RESISTANCE (Ohms) − 44 / 1150 − 48 / 1280 − 52 / 1400
PULSE TIMING	
Make period:	10 msec ≤ make < 60 msec
Break period:	10 msec ≤ break < msec
Off hook (make):	≥ 70 msec
On hook (break):	≥ 235 msec
Interdigital period:	≥ 275 msec
ACCURACY OF MIN. PULSE WIDTH control:	± 5 msec

Table 2—1. (Cont'd.)

INPUT RESISTANCE	
Tip to ring:	≥ 400 kohms
Tip to ground, ring to ground:	≥ 200 kohms
DIAL PULSE RECEIVER (E&M)	
SENSITIVITY Indicated voltages are referenced to CO ground (2763 case)	
E lead on hook:	− 10 V to − 52 V or open
off hook:	more positive than − 8 V
M lead on hook:	more positive than − 8 V
off hook:	− 10 V to − 52 V
INPUT RESISTANCE	
E to ground, M to ground:	≥ 200 kohms
POWER REQUIREMENTS:	117/234 ± 10 V ac, 50/60 Hz, 25 Watts
ENVIRONMENTAL REQUIREMENTS	
TEMPERATURE	
Operating:	0 °C to 50 °C (32 °F to 122 °F)
Storage:	− 40 °C to 70 °C (− 40 °F to 158 °F)
RELATIVE HUMIDITY:	0 % to 85 %
PHYSICAL CHARACTERISTICS	
Size in case and cover (handles and hinges not included)	36.2 cm l x 21 cm w x 34.3 cm h (14¼ in. l x 8¼ in. w x 13½ in. h)
Weight (in case)	7 kg (16 lb.)

SECTION 3

INSTALLATION

3.1 This section contains information needed for installation and interfacing of the Model 2763, 2763A, and 2763R DP/MF/DTMF Signaling Displays. The information includes:

1. initial inspection (paragraph 3.2),

2. service information (paragraph 3.4),

3. installation of the signaling displays (paragraph 3.9 and 3.11),

4. E&M internal switch settings (paragraph 3.17), and

5. printed circuit board access (paragraph 3.19 and 3.21).

3.2 INITIAL INSPECTION

3.3 The signaling display is carefully inspected, both mechanically and electrically before shipment. It should be working properly when received. If damage from transit is found, notify the transportation carrier immediately.

3.4 SERVICE INFORMATION

3.5 Complete warranty information is contained in the purchase order agreement under terms and conditions of sale. Summarized briefly, the Northeast Electronics warranty extends for a period of one year to the original purchaser of a Northeast test instrument. Northeast's system products are covered by a special warranty which can be summarized as follows.

- ☐ Hardware items are warranted for a period of 90 days.
- ☐ Software is warranted for a period of one year.

3.6 It is recommended that Northeast's Repair Department be contacted for assistance if, for any reason, a Northeast product fails to perform as expected. This step eliminates the needless delay entailed when a product is returned unnecessarily. Contact the Repair Department at Northeast Electronics, Concord, New Hampshire 03301, telephone: (603) 228-3700 or (800) 222-4124 (outside NH).

3.7 If a Northeast Electronics product requires factory servicing **during** the warranty period, be sure to include a ship-to address and a description of the problem when returning the product to Northeast Electronics.

After the warranty period has expired, equipment returned must be accompanied by all of the following:

- ☐ The number of the purchase order covering the cost of servicing,
- ☐ Bill-to address,
- ☐ Ship-to address, and
- ☐ Description of problem.

3.8 In all cases, Northeast Electronics products should be returned directly to our Factory Service Center in Concord, New Hampshire for repair. Any material requiring repair must be returned to Northeast via a Return Material Authorization (RMA) Number, which will be assigned by the Service Center Order Processing Administrator. Customers may call the Factory Service Center at (603) 228-3700 or (800) 222-4124 (outside NH) for the assignment of the number.

3.9 INSTALLING PORTABLE MODELS 2763/2763A DP/MF/DTMF SIGNALING DISPLAYS

3.10 The Models 2763 and 2763A do not require special installation instructions. The signaling displays may be placed on any convenient work surface and connected to a power source (refer to paragraph 4.6). All connections to circuits under test are made via front panel input/output type 310 jacks.

3.11 INSTALLING RACK-MOUNT MODEL 2763R DP/MF/DTMF SIGNALING DISPLAY

3.12 The Model 2763R is supplied with hardware for mounting in a 19-inch (438 mm) rack. A rack mounting bracket (pn C2765-00-109) for installation in a 23-inch (584 mm) rack is available on special order.

3.13 Cooling air intake and exhaust vents located on the rear of the Model 2763R should not be obstructed.

3.14 To mount the Model 2763R in a rack, do the following steps.

1. Remove the two retaining screws located at the rear of the case below the rear panel. These screws hold the chassis secured to the case.

2. Slide the chassis completely out of the case.

3. Fasten the two rack-mount brackets to the sides of the case with 10-32 3/8" long bevel head screws. See Figure 3—1.

4. Install case with brackets in a rack.

5. Slide chassis back into case and secure with the two retaining screws removed in step 1.

NOTE

When installing in a rack, ensure that all cable connections to the Model 2763R have service loops approximately 1½ feet (457 mm) long. This permits pulling the chassis out of the case should service be required from the front.

6. Connect the signaling display to a power source. Refer to paragraph 4.6

7. The signaling display can operate as a stand-alone unit or as part of a signaling test system. See Figure 3—2 and 3—3 for interconnection data when using the Model 2763R in conjunction with Model 2776 Trunk Access Unit(s) and/or Model 2765A Call Disposition Analyzer.

3.15 Connections to circuits under test may be made either via front panel type 310 jacks or a rear panel barrier strip. Figure 3—4 shows the parallel wiring that exists between the front panel jacks and the rear barrier strip.

3.16 When a Model 2763R operates with a Model 2765A Call Disposition Analyzer, the two units are connected to each other via a four-foot cable (pn A2765-00-025). Figure 3—5 shows the pin-out of the external equipment connector jacks and Table 3—1 lists the signals appearing at this jack. The external equipment connector jack is located on the rear of the Model 2763R.

3.17 E&M INTERNAL SWITCH SETTINGS

3.18 The signaling display can accommodate various types of E&M signaling systems. Two dual switches mounted on the line conditioner board configure on-/off-hook detector circuits. Briefly, a detector circuit can be programmed via the switches either as a ground detector (potential more positive than − 8 V) or as a battery detector (potential more negative than − 20 V). In addition, the detector is instructed to interpret the specified state as either an on hook or an off hook.

Figure 3—6 shows the switch locations on the line conditioner board and Table 3—2 lists the resulting on-/off-hook detection requirements set by the switches. Refer to paragraphs 3.19 and 3.21 for instructions to access the line conditioner board in the Models 2763/2763A and Model 2763R respectively.

3.19 PC BOARD ACCESS IN MODEL 2763/2763A

3.20 To obtain access to a board inside the card cage of the Model 2763/2763A, do the following:

1. Shut down the signaling display and disconnect the power cord.

2. Remove the chassis from the case . . . four screws on the front panel and one screw on each side secure the chassis to the case.

3. Locate the pc card retainer bracket (located at the rear of the chassis) and remove the three screws holding the retainer bracket secured to the top edge of the chassis.

4. Remove the retainer bracket to provide free access to the boards inside the card cage.

3.21 PC BOARD ACCESS IN MODEL 2763R

3.22 It is not necessary to remove the Model 2763R from a rack for obtaining access to a board inside the card cage.

1. Shut down the signaling display and disconnect the power cord.

2. Remove the rear panel . . . four screws hold the rear panel secured to the case.

3. Locate the pc card retainer bracket and remove the three screws holding the retainer bracket secured to the top edge of the chassis.

4. Swing the retainer bracket downward to provide free access to the boards inside the card cage.

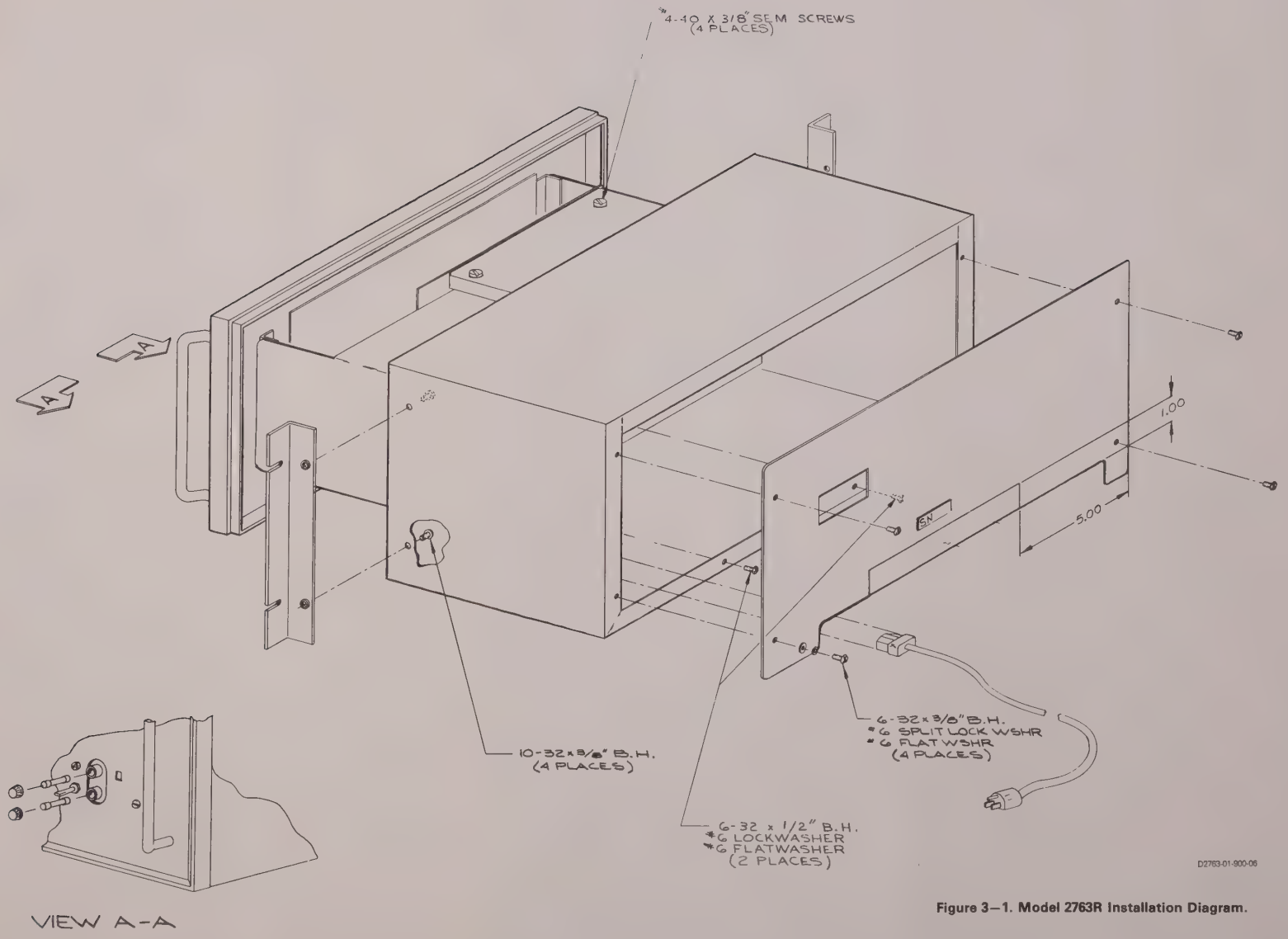


Figure 3—1. Model 2763R Installation Diagram.

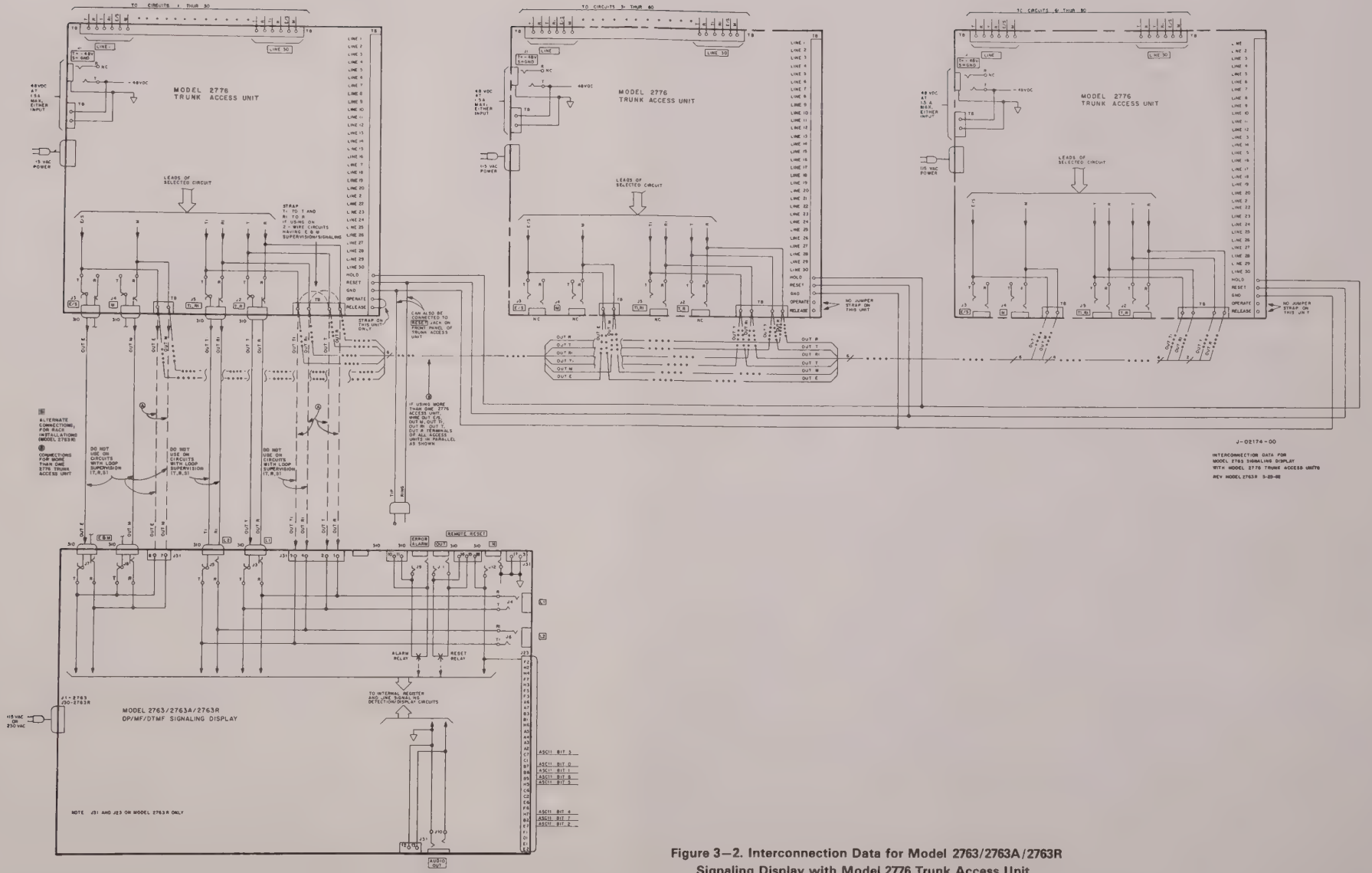


Figure 3—2. Interconnection Data for Model 2763/2763A/2763R Signaling Display with Model 2776 Trunk Access Unit.

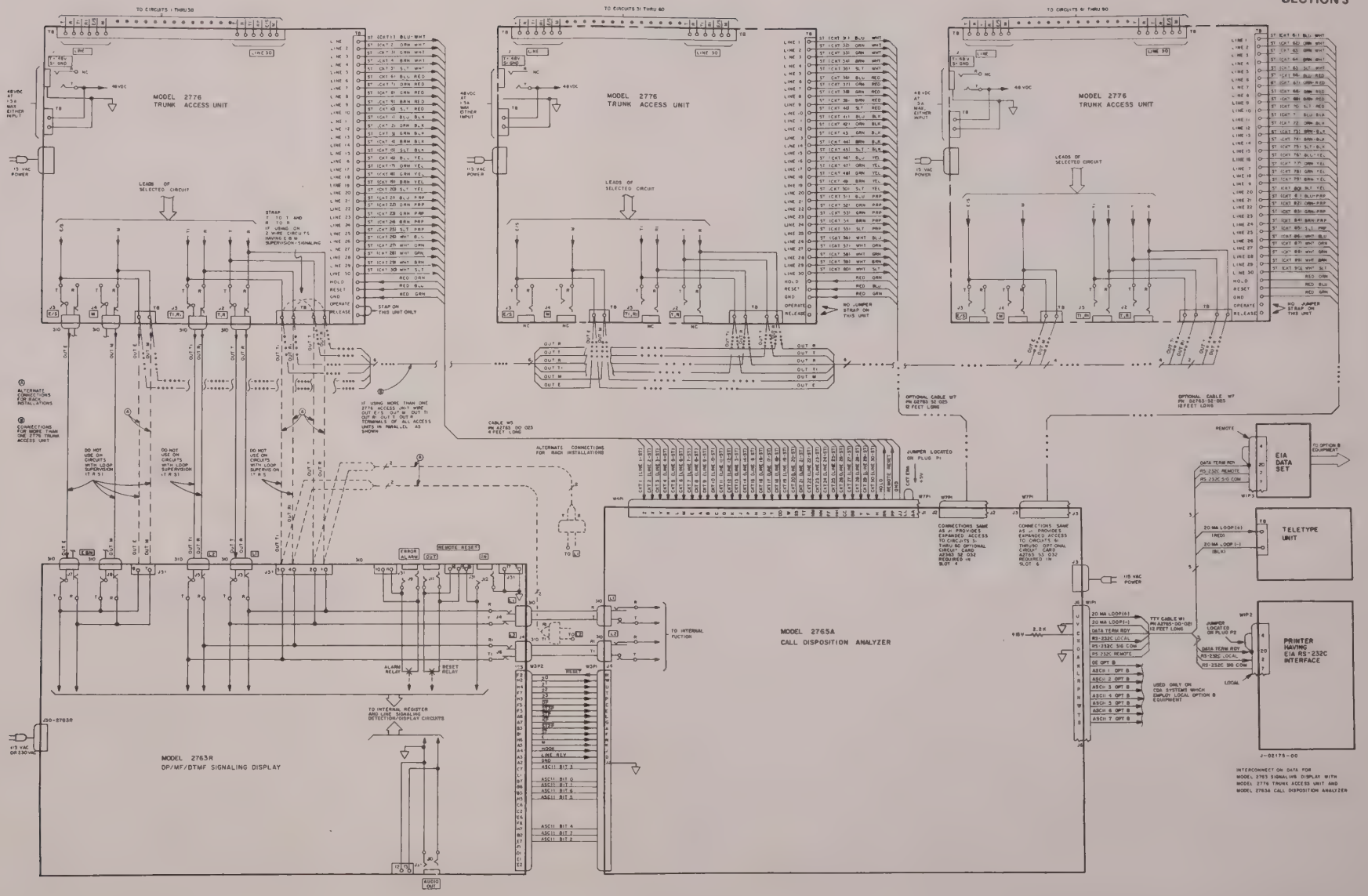
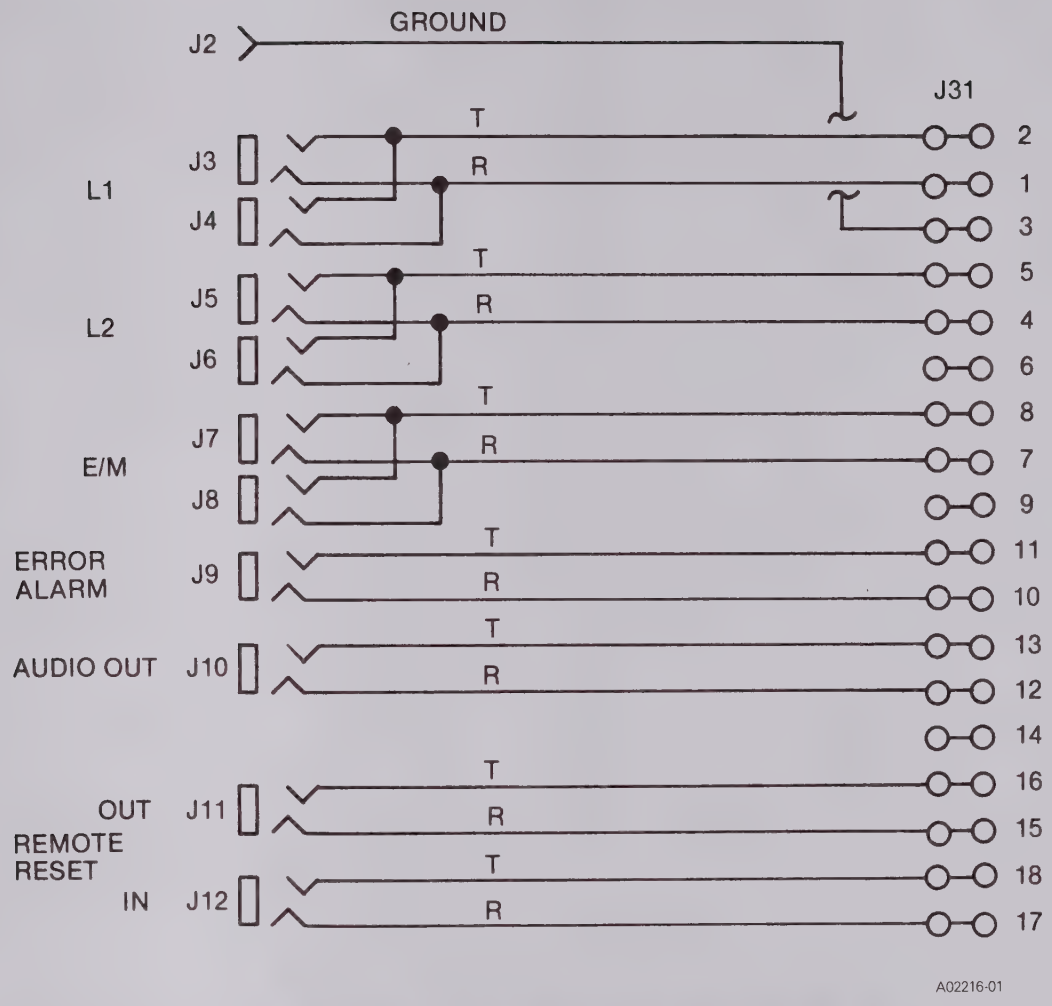


Figure 3—3. Interconnection Data for Model 2763R Signaling Display with Model 2776 Trunk Access Unit and Model 2765A Call Disposition Analyzer.



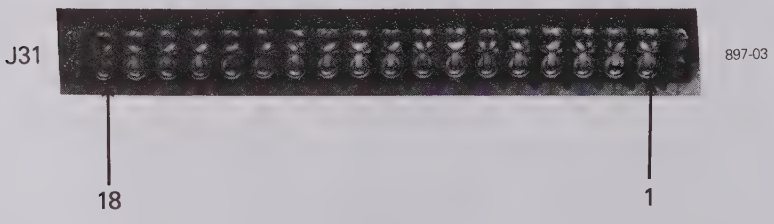


Figure 3—4. Front Panel to Rear Barrier Strip Interconnection.

Table 3—1. External Equipment Data Bus Signals (Model 2763R).

J23 (33 PINS)	SIGNAL
A2	GND
A3	LINE REV
A4	OFF-HOOK
A5	$\overline{M}$
A6	$\overline{STP}$
A7	$\overline{KP}$
B1	$\overline{ST}$
B2	ASCII BIT 7
B3	$\overline{ST2P}$
B5	ASCII BIT 6
B6	ASCII BIT 1
B7	ASCII BIT 0
C1	PRINTER DATA READY
C2	NC
C6	NC
C7	ASCII BIT 3
D1	NC
E1	NC
E2	NC
E6	NC
E7	ASCII BIT 2
F1	GND
F2	$\overline{RESET}$
F3	$\overline{ST3P}$
F5	$\overline{DP}$
F6	NC
F7	2^2
H2	2^0
H3	2^3
H4	2^1
H5	ASCII BIT 5
H6	E
H7	ASCII BIT 4

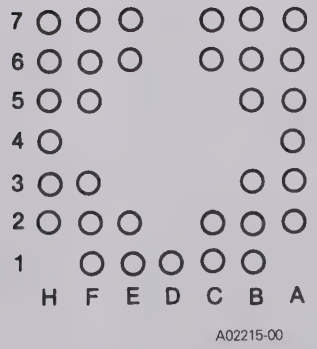
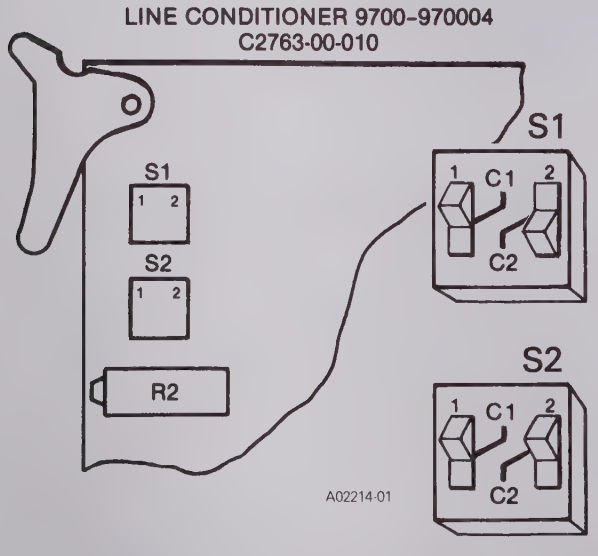


Figure 3—5. Pin-out for External Equipment Data Bus Connector Jack (Model 2763R).

Table 3—2. E&M Internal Switch Settings.

LEAD CONDITION	THRESHOLD SWITCH POSITION	SWITCHING POINT (± 2 V)	INDICATION SWITCH POSITION	INDICATION SHOWN BY A16CR9 OUT = ON HOOK LIGHTED = OFF HOOK
E LEAD	**S2-C2**		**S1-C1**	
*Battery or open	ON	– 8 V	ON	ON HOOK
*Ground	ON	– 8 V	ON	OFF HOOK
Battery or open	ON	– 8 V	OFF	OFF HOOK
Ground	ON	– 8 V	OFF	ON HOOK
Battery	OFF	– 20 V	ON	ON HOOK
Ground or open	OFF	– 20 V	ON	OFF HOOK
Battery	OFF	– 20 V	OFF	OFF HOOK
Ground or open	OFF	– 20 V	OFF	ON HOOK
M LEAD	**S2-C1**		**S1-C2**	
Battery	ON	– 20 V	ON	ON HOOK
Ground or open	ON	– 20 V	ON	OFF HOOK
*Battery	ON	– 20 V	OFF	OFF HOOK
*Ground or open	ON	– 20 V	OFF	ON HOOK
Battery or open	OFF	– 8 V	ON	ON HOOK
Ground	OFF	– 8 V	ON	OFF HOOK
Battery or open	OFF	– 8 V	OFF	OFF HOOK
Ground	OFF	– 8 V	OFF	ON HOOK

* Denotes factory switch settings as shown in Figure 3—6.



NOTES.

1. Switch S1 is shown with C1 in the "ON" position, and with C2 in the "OFF" position.
2. Switch S2 is shown with both C1 and C2 in the "ON" positions.
3. For the C1 "ON" position, pins C1 and 1 are shorted (closed).
4. For the C2 "ON" position, pins C2 and 2 are shorted (closed).

Figure 3—6. Internal Switch Locations.

SECTION 4

OPERATION

4.1 This section provides the information needed for proper operation of the DP/MF/DTMF Signaling Displays. The information is organized as follows:

1. Differences between the portable Model 2763/2763A and the rack-mount Model 2763R (paragraph 4.2);

2. Controls, indicators, and connectors (paragraph 4.4);

3. Test set power up sequence (paragraph 4.6);

4. Sequential call monitoring control settings (paragraph 4.7);

5. Signaling converter monitoring control settings (paragraph 4.9);

6. Display symbols (paragraph 4.12);

7. Displays and user memory (paragraph 4.14);

8. Operating controls (paragraph 4.28);

9. Notes on dial pulse operation (paragraph 4.54);

10. Notes on DTMF operation with ERROR FUNCTION disabled (paragraph 4.61) and enabled (paragraph 4.65);

11. Notes on MF operation with ERROR FUNCTION disabled (paragraph 4.69) and enabled (paragraph 4.74);

12. Backward signaling and display (paragraph 4.77);

13. Operation under abnormal conditions (paragraph 4.82);

14. Diagnostic operation in dial pulse systems (paragraph 4.86); and

15. Diagnostic operation in MF signaling systems (paragraph 4.101).

NOTE

Both the Model 2763/2763A and the Model 2763R operate identically. All operating instructions and descriptions apply to both the 2763/2763A and 2763R.

4.2 DIFFERENCES BETWEEN THE PORTABLE MODEL 2763/2763A AND RACK-MOUNT MODEL 2763R

4.3 The differences between the 2763/2763A and 2763R are physical rather than electrical or functional.

1. The 2763/2763A is a portable unit while the 2763R is a rack-mount unit.

2. The Model 2763/2763A has a power jack on the front panel and the 2763R has a power jack at the rear.

3. An external equipment connector is located at the rear of the 2763R.

4. The 2763R has a barrier strip at the rear, the 2763/2763A does not. The terminals on the barrier strip are connected in parallel with the front panel input/output jacks as shown in Figure 3—4.

4.4 CONTROLS, INDICATORS, AND CONNECTORS

4.5 Figures 4—1 and 4—2 show the front panel controls, indicators and connectors of the Models 2763, 2763A, and 2763R. Rear panel connectors on the 2763R are shown in Figure 4—3. Table 4—1 briefly describes the function of each control, indicator, and connector.

4.6 TEST SET POWER UP SEQUENCE

1. Ensure the POWER switch is set at off (down).

2. Ensure the 115/230 slide switch matches the power source to be used . . . either 115 V ac, 50/60 Hz or 230 V ac, 50/60 Hz source.

WARNING

For safety reasons and for reliable dial pulse operation, it is essential that the 2763 test set have an earth ground connection. A proper ground can be ensured by either of the following methods:

A. Ground connection via power plug

1. Ensure that the third lead of the power outlet connects to earth ground.

2. Do not isolate the NEMA ground lead in the power cord.

B. Ground lug connection

1. Connect the front panel ground lug to a clean frame ground.

3. Remove power cord from the cover compartment and connect it to the power plug. Insert the other end into the power source outlet.

4. Set the POWER switch to ON and observe that the POWER indicator is lighted.

5. Should the POWER indicator fail to turn on . . . set the POWER switch to off and check the fuses.

6. Press the DISPLAY switch and observe that the display shows a number between 20 and 99.

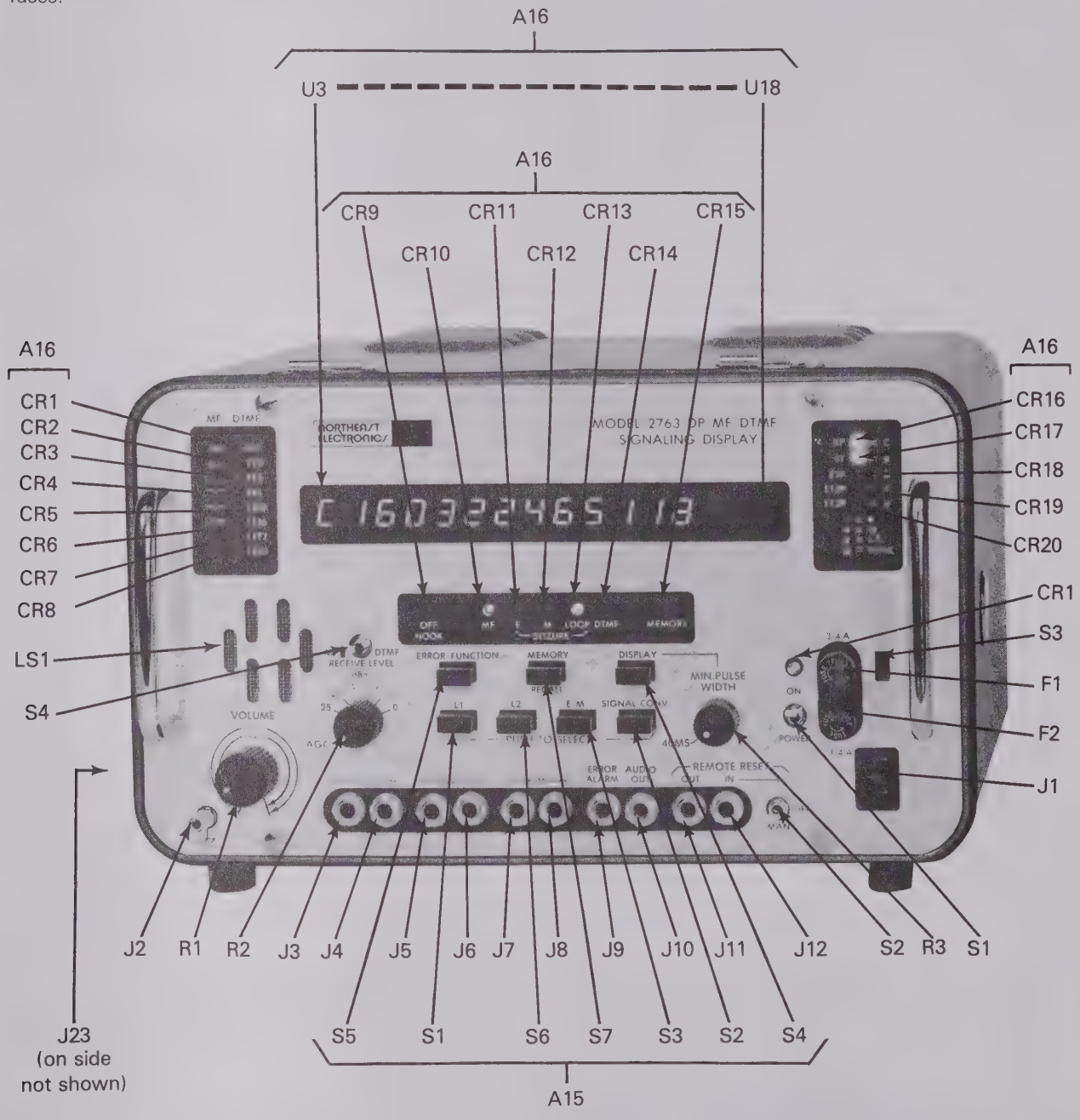


Figure 4—1. Model 2763/2763A Controls, Indicators, and Connectors.

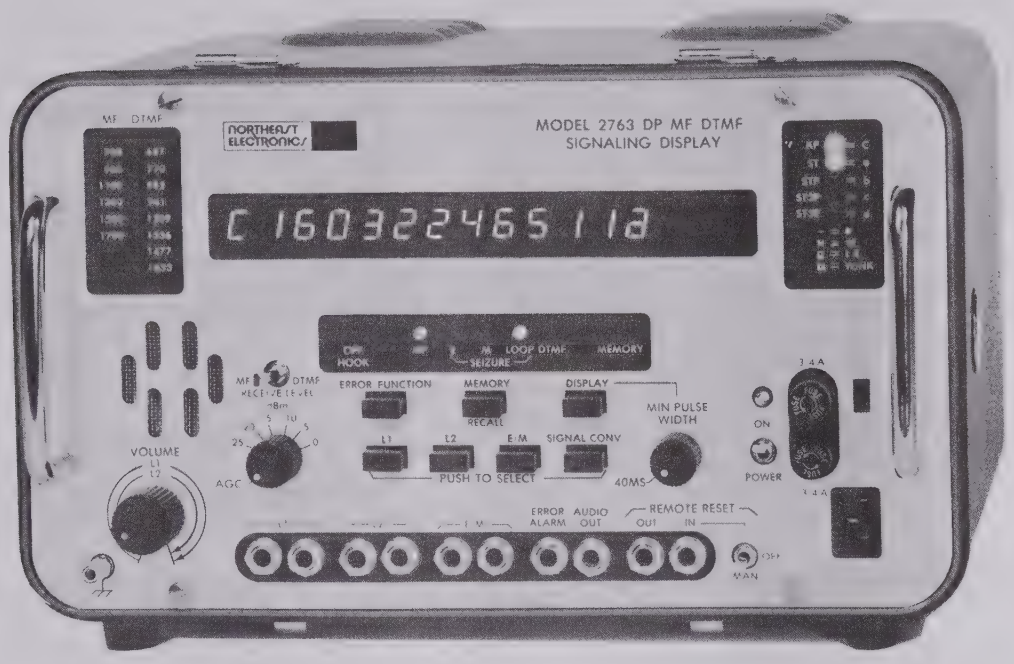


Figure 4—2. Model 2763R Front Panel Controls, Indicators, and Connectors.

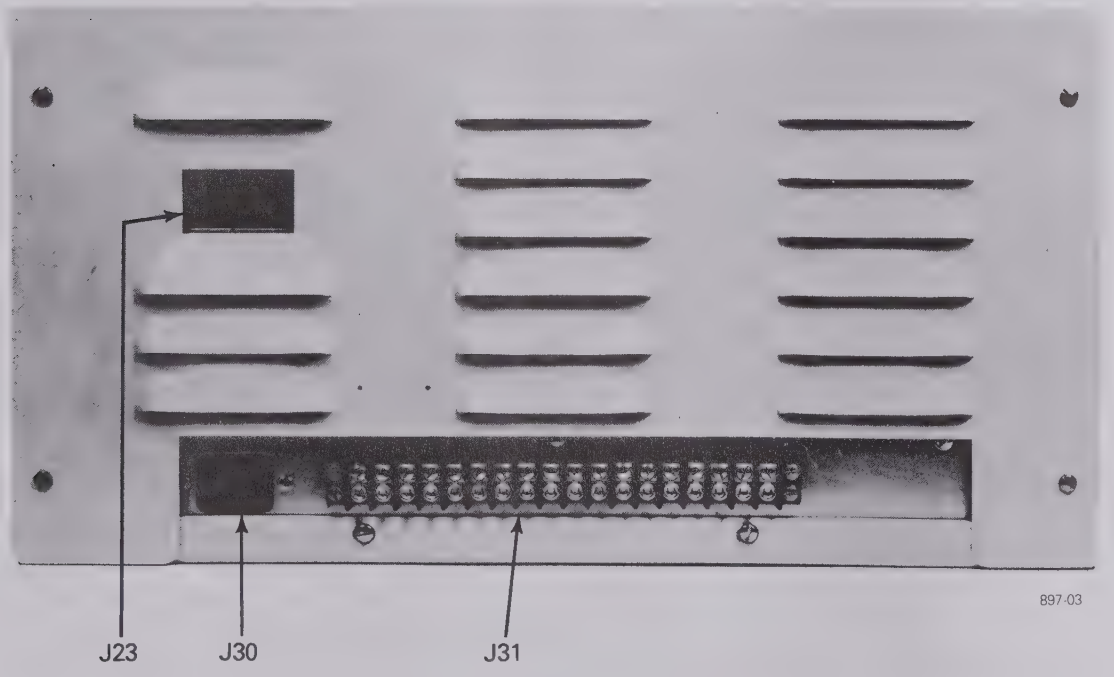


Figure 4—3. Model 2763R Rear Panel Connectors.

Table 4—1. Controls, Indicators, and Connectors.

REFERENCE DESIGNATION	NOMENCLATURE	DESCRIPTION
INPUT / OUTPUT		
J3,J4	L1 phone jacks, mate with type 310 plugs or type 241 twin-plugs	Provides a through connection using a double plug. Bridges the 2763 across a loop circuit under test.
J5,J6	L2 phone jacks, mate with type 310 plugs or type 241 twin-plugs	Provides a through connection using a double plug. Bridges the 2763 across a loop circuit under test.
J7,J8	E/M phone jacks, mate with type 310 plugs or type 241 twin-plugs	Provides a through connection using a double plug. Bridges the 2763 across E/M circuit under test.
J9	ERROR ALARM phone jack, mates with type 310 plug	Provides a contact closure when the 2763 detects an error in the monitored signaling (ERROR function enabled). Contact closure rated at 110 V and 1 A.
J10	AUDIO OUT phone jack, mates with type 310 plug	Provides the combined output of the signal present at input ports L1 and L2. The VOLUME controls set the level at the AUDIO OUT jack.
LS1	Loudspeaker	Provides the audio present on input ports L1 and L2. Sound level depends on input signal levels and VOLUME L1 and L2 control setting.
R1	VOLUME L1, L2 dual concentric potentiometer	Controls the audio level heard on the loudspeaker and signal level present at the AUDIO OUT jack.
J11	REMOTE RESET OUT phone jack, mates with type 310 plug	Supplies a contact closure to reset external equipment. Contact closure occurs on: 1. Manual reset via front panel 2. Reset received from Model 2765A 3. External reset applied at REMOTE RESET IN jack with REMOTE RESET switch set at IN
J12	REMOTE RESET IN phone jack, mates with type 310 plug	Provides an input port to apply a reset signal from external equipment. The 2763 accepts a remote reset signal only if REMOTE RESET switch set is at IN. Reset signal may either be a contact closure between tip and ring or a ground on the tip. All remote resets (accepted internally or not) are repeated and routed as contact closures to the REMOTE RESET OUT jack.

Table 4—1. (Cont'd.)

REFERENCE DESIGNATION	NOMENCLATURE	DESCRIPTION
INPUT / OUTPUT (Cont'd.)		
J31 (Only on 2763R)	Strip connector	Provides hard-wire termination for permanent installation of a rack-mounted Model 2763R. Contacts on the barrier strip located at the rear of the unit are connected in parallel with front panel input/output jacks J2 through J12. See Figure 4—3.
J23	Accessory output connector	Provides information concerning MF and DTMF data, MF codes and frequencies, data present, and reset supervision including line reversal and off hook. These outputs are intended for use with auxiliary equipment such as Model 2765A Call Disposition Analyzer, printers, and computers. The connector is located on the left side of the Model 2763, and located at the rear on the Model 2763R.
S2	REMOTE RESET 3-position toggle switch	Determines the acceptability of remote reset. OFF position: ignores all remote resets applied either at the REMOTE RESET IN jack or from a Model 2765A CDA. MAN (momentary action) position: initializes internal circuitry. Contact closure applied to REMOTE RESET OUT jack as long as REMOTE RESET switch is held at MAN. IN position: accepts remote resets applied either at the REMOTE RESET IN jack or from a Model 2765A CDA. The remote reset initializes internal circuitry. **NOTE** The 2763 repeats and routes all remote resets as contact closures to the REMOTE RESET OUT jack regardless of the setting of the REMOTE RESET switch.
DISPLAYS		
A16U3-U18	16-character, 7-segment digit display	Displays available data on a call. . . . either the current call or a call stored in memory as determined by the MEMORY RECALL switch.

Table 4—1. (Cont'd.)

REFERENCE DESIGNATION	NOMENCLATURE	DESCRIPTION
DISPLAYS (Cont'd.)		
A16CR1-CR8	MF/DTMF light emitting diodes	Displays the MF or DTMF frequencies present at input ports L1 and L2 as identified by the MF or DTMF indicators. When ERROR FUNCTION is enabled, the MF-DTMF LED display latches on the first detected signaling error.
A16CR9-CR15	status LEDs (light emitting diodes)	E,M, LOOP: one of these three LEDs lights up to identify the type of seizure detected . . . if more than one circuit is under test then only the first seizure is displayed. MF, DTMF: one of these two LEDs lights up to identify the type of seizure detected. The lighted LED also identifies the frequency set shown on the MF-DTMF display. OFF HOOK: indicates the on-/off-hook status of the seized circuit under test . . . out for on hook and lighted for off hook. This indicator flashes off and on during dial pulsing on the seized circuit. MEMORY: indicates that the memory has data on a call.
A16CR16-20	MF CODES light emitting diodes	KP: indicates the detection of a "key pulse" during the MF signaling portion of a call with MF/DTMF switch set at MF. ST,STP,ST2P,ST3P: one of these four LEDs lights up to identify the "start pulse" detected during the MF signaling portion of a call with MF/DTMF switch set at MF.
OPERATING MODE CONTROLS		
A15S1	L1 push-push action switch	When in, connects input port L1 to internal measuring circuitry.
A15S6	L2 push-push action switch	When in, connects input port L2 to internal measuring circuitry.
A15S3	E/M push-push action switch	When in, connects input port E/M to internal measuring circuitry. **NOTE** When E/M is latched on, the 2763 monitors only the E and M leads for supervision signaling.

Table 4—1. (Cont'd.)

REFERENCE DESIGNATION	NOMENCLATURE	DESCRIPTION
OPERATING MODE CONTROLS (Cont'd.)		
A15S2	SIGNAL CONV. push-push action switch	When out, calls are processed sequentially. Data on the current call appears on display while memory holds data on the previous call. When in, two calls are processed in parallel . . . used when testing (DTMF-to-pulse, pulse-to-MF, and MF-to-pulse converters). While testing DTMF to pulse converters . . . DTMF signaling data appears on the display while the pulse signaling data goes to the memory. While testing pulse-to-MF or MF-to-pulse converters . . . pulse signaling data appears on the display while the MF signaling data goes to the memory.
A15S5	ERROR FUNCTION push-push action switch	When in, enables the 2763 to detect and display signaling errors.
A15S7	MEMORY RECALL momentary action switch	When in, the data from memory appears on the display.
A15S4	DISPLAY momentary action switch	When in, the value set for minimum pulse width appears on the display. The value stays on for about two seconds after release of the DISPLAY switch.
R3	MIN. PULSE WIDTH potentiometer type control with detent position	Sets the minimum pulse width threshold for accepting pulses . . . either dial or tone pulses. The selectable range extends from approximately 15 to 99 msec. The detent position sets the minimum pulse width at 40 msec. The 2763 ignores any pulse with a width less than the set value. The display shows the new minimum pulse width anytime the control is set to a new position. The minimum pulse width display remains on for about two seconds after the last detected position change.
S4	MF/DTMF	Enables the 2763 to detect and display either MF or DTMF signaling present at input ports L1 and L2.
R2	RECEIVER LEVEL potentiometer type control with detent position	Sets the minimum acceptable level for MF and DTMF tones. Control range markings are from − 25 dBm to 0 dBm. A detent position provides AGC operation. A 38-dB typical dynamic range with minimum sensitivity of − 26 dBm results in the AGC position.

Table 4—1. (Cont'd.)

REFERENCE DESIGNATION	NOMENCLATURE	DESCRIPTION
POWER GROUP		
J1 (Model 2763) J30 (Model 2763R)	ac receptacle	Accepts 115 V ac or 230 V ac to power the 2763.
S1	POWER toggle switch	Applies input power to the 2763.
S3	slide switch	Enables 2763 to accept either 115 V ac or 230 V ac, 50-60 Hz.
F1,F2	¾ A fuses	Protects against excessive input current.
CR1	LED indicator	Lights to show that the unit is powered.
J2	ground lug	Provides access to chassis ground.

4.7 SEQUENTIAL CALL MONITORING CONTROL SETTINGS

4.8 The following control settings are acceptable to monitor most types of **sequential calls** (or serial calls) with the called number transmitted as MF, DTMF or dial pulsing. These control settings can also handle CAMA (or TSPS) calls since each portion of such calls is automatically processed separately by the 2763.

1. Set VOLUME controls L1 and L2 at midrange.

2. Set RECEIVE LEVEL at AGC (detent position).

3. Set MIN. PULSE WIDTH at 40 MS (detent position).

4. Ensure that ERROR FUNCTION is not selected (pushbutton out).

5. Ensure that SIGNAL CONV. is not selected (pushbutton out).

6. Refer to Table 4—2 and patch the transmission pairs to input port L1, L2 and E&M in accordance with the type of dialing and supervision to be monitored.

7. Refer to Table 4—2 and set up controls L1, L2, E/M, and MF/DTMF in accordance with the type of dialing and supervision to be monitored.

8. Momentarily set the RESET switch at MAN to clear the display and user memory buffers.

NOTE

The RESET switch should be set at REMOTE when operating in conjunction with other equipment such as a Model 2765A.

Table 4—2. Control Settings and Patching for Sequential Call Monitoring.

TYPE OF		NUMBER OF PAIRS	SWITCH SETTINGS				PATCHING (refer to note 3)	
DIALING	SUPERVISION		MF/ DTMF	L1	L2	E/M	FROM 2763	TO PATCH BAY
DTMF	loop	1	DTMF	L1 or L2 in		out	L1 or L2 in	T1/R1 or T2/R2
DTMF	loop	2	DTMF	L1 and L2 in		out	L1 and L2	T1/R1 and T2/R2
loop DP	loop	1	refer to note 1	L1 or L2 in		out	L1 or L2	T1/R1 or T2/R2
loop DP	loop	2	refer to note 1	L1 and L2 in		out	L1 & L2	T1/R1 and T2/R2
E or M DP	E&M (refer to note 4)	1		L1 and L2 out (refer to note 2)		in	E/M	E&M
loop DP-MF (CAMA)	loop (refer to note 5)	1	MF	L1 or L2 in		out	L1 or L2	T1/R1 or T2/R2
E or M DP-MF (CAMA)	E&M (refer to notes 4 and 5)	1	MF	L1 or L2 in		in	L2 or L2 E/M	T1/R1 or T2/R2 E&M
MF-MF (CAMA)	loop (refer to note 5)	1	MF	L1 or L2 in		out	L1 or L2	T1/R1 or T2/R2
MF-MF	E&M (refer to notes 4 and 5)	1	MF	L1 or L2 in		in	L1 or L2 E/M	T1/R1 or T2/R2 E&M

NOTES:

1. To inhibit the 2763 from detecting MF tones, set the MF/DTMF switch at DTMF.

2. To monitor voice signals, connect the transmission path to L1 or L2 . . . voice signals can then be heard on the speaker whether or not the L1 or L2 loop pushbuttons are in or out.

3. Make connections from the 2763 to the patch bay as to maintain continuity in the transmission path. Use type 241 jacks (dual 310), otherwise the transmission path may be opened and an on-hook condition imposed. Type 310 jacks may be used for connections into bridging monitor plugs.

4. When the E/M switch is latched on, the 2763 accepts only supervision signals which appear on the E and M leads.

5. MF signals can be monitored independently of supervision . . . loop or E&M supervision need not be present to detect MF signals. (must be preceded by a KP)

4.9 SIGNALING CONVERTER MONITORING CONTROL SETTINGS

4.10 The 2763 has the capability to monitor dc signaling (loop or E&M) while simultaneously monitoring ac signaling (MF or DTMF). This feature enables the 2763 to monitor signaling converters of various types such as:

a. dial pulse-to-MF,

b. MF-to-dial pulse,

c. DTMF-to-loop dial pulse,

d. dial pulse-to-DTMF, and

e. DTMF-to-E&M dial pulsing.

4.11 To monitor signaling converters set the 2763 controls as follows:

1. Set VOLUME controls L1 and L2 at midrange.

2. Set RECEIVE LEVEL at AGC (detent position).

3. Set MIN. PULSE WIDTH at 40 MS (detent position).

4. Ensure that ERROR FUNCTION is not selected (pushbutton out).

5. Ensure that SIGNAL CONV. is enabled (pushbutton in).

6. Refer to Table 4—3 and patch the input and output transmission pairs to the 2763 in accordance with the type of signaling converter to be monitored.

7. Refer to Table 4—3 and set up controls L1, L2, E/M and MF/DTMF in accordance with the type of signaling converter to be monitored.

8. Momentarily set the RESET switch at MAN to clear the display and user memory buffers.

NOTE

Each new seizure automatically clears the display. No need to reset the 2763 between conversions.

9. After completion of a signaling conversion, push in the MEMORY RECALL switch to bring the data in the user memory on the display. Compare memory data with display data.

Table 4—3. Control Settings and Patching for Signaling Converter Monitoring.

CONVERTER	SWITCH SETTING				PATCHING		DATA STORAGE	
	MF/ DTMF	L1	L2	E/M	FROM 2763	TO CONVERTER	DISPLAY	USER MEMORY
DP to MF MF to DP	MF	L1 and L2 in		out	L1 (or L2) L2 (or L1)	TI/R1 T0/R0	DP	MF
DTMF to DP DP to DTMF	DTMF	L1 and L2 in		out	L1 (or L2) L2 (or L1)	TI/R1 T0/R0	DTMF	DP
DTMF to E&M	DTMF	L1 (or L2) in		in	L1 (or L2) E/M	TI/R1 T0/R0	DTMF	DP

4.12 DISPLAY SYMBOLS

4.13 The monitored data appears on a 16-character 7-segment display. The 2763 uses unique symbols to represent digits and special codes: (See Figures 4—4 through 4—21.)

1. ten symbols for digits 0-9;

2. seven symbols for special MF codes, DTMF codes, and sequence of dial pulses greater than 10;

3. three symbols for backward supervision signaling; and

4. one symbol for "error" indication.

4.14 DISPLAYS AND USER MEMORY

4.15 The 2763 has a display which shows the dialed digits and backward signaling monitored on a call. The signaling display stores up to 16 characters . . . 1 character per digit or signaling event. A user memory can also hold data on a monitored call.

4.16 The data in the user memory pertains to either the previously monitored call (sequential call monitoring) or to a portion of the current call when testing signaling converters. When monitoring sequential calls, a new seizure causes the transfer of the data from the display into the user memory. A lighted MEMORY indicator informs the user that the memory contains data.

4.17 Three groups of light emitting diodes (LEDs) provide additional data on a monitored call. The first group of LEDs on the left-hand side shows the frequency content of a signal. The second group of LEDs on the right-hand side pertains to MF signaling. The third group of LEDs located beneath the 16-character display identifies the seizure and signaling mode. The state of these LEDs form an integral part of the data display of a call sequence. The information displayed by these LEDs is also stored in the user memory when the 2763 transfers the display data into the user memory.

4.18 Pressing the RECALL pushbutton brings the data stored in the user memory to the display and LEDs. The data formerly on the display and LEDs is placed in a temporary memory. Recalling data from the user memory while currently monitoring a call does not cause any loss of data . . . the new data simply goes to the temporary memory.

4.19 MF-DTMF FREQUENCY DISPLAY

4.20 The MF-DTMF frequency display (a set of eight LEDs) shows the frequency content of a signal . . . a valid MF or DTMF signal consists of two and only two frequencies. Tables 4—4 and 4—5 list the codes and frequencies for MF and DTMF signaling respectively. The MF/DTMF switch determines whether the MF-DTMF frequency display pertains to an MF or DTMF signal. Usually the frequency display is a real-time display . . . refer to paragraphs 4.65 and 4.74 for conditions which latch this display.

Table 4—4. MF Number and Code Tone Pairs.

DIGIT OR CODE	FREQUENCIES (Hz)					
	700	900	1100	1300	1500	1700
1	X	X				
2	X		X			
3		X	X			
4	X			X		
5		X		X		
6			X	X		
7	X				x	
8		X			X	
9			X		X	
0				X	X	
ST3P	X					X
STP		X				X
KP			X			X
ST2P				X		X
ST					X	X

Table 4—5. DTMF Tone Pairs.

		HIGH-GROUP FREQUENCIES (HZ)			
		1209	1336	1477	1633
LOW-GROUP FREQUENCIES (HZ)	697	1	2	3	A
	770	4	5	6	B
	852	7	8	9	C
	941	*	0	#	D

4.21 KP AND ST DISPLAY

4.22 The key pulse (KP) and start pulse (ST) display (located on the right side of the signaling display) pertain to MF signaling only. Tables 4—6 and 4—7 list the special codes and frequencies associated with various MF signaling systems.

4.23 SEIZURE AND SIGNALING MODE DISPLAY

4.24 The OFF HOOK indicator shows on-/off-hook supervision for all dial pulse signaling modes. The indicator turns on when off hook exists and follows dial pulsing . . . either on loop (L1 or L2 input port) or E&M (E/M input port) circuits.

4.25 The MF and DTMF indicators identify the type of tone signaling observed on the monitored call. When both these indicators are off, then the called number was dc dial pulsed.

4.26 A lighted LOOP LED indicates that loop seizure was observed on L1 or L2. The OFF HOOK indicator continuously shows the on- and off-hook status of the seized loop circuit. Dial pulsing causes the OFF HOOK indicator to flash on and off.

4.27 For E&M supervised calls, either the E or M indicator is latched on to identify the lead that seizure occurred on. Signaling on the seized lead is called forward signaling and signaling on the other lead is called backward signaling. The OFF HOOK indicator shows the on- and off-hook state of the seized lead. Therefore, dial pulsing also causes the OFF HOOK indicator to flash. Backward signaling is indicated by the nonlatched E or M indicator. Note that the 2763 accepts only the supervision signals appearing on the E and M leads when the E/M switch is latched on. Loop dc conditions are ignored during the remainder of the current call.

Table 4—6. Use of Codes 11 Through 15 by Various Signaling Systems.

TRANSMITTED MF CODES					
R1 MF Pulsing	KP (Prepare for digits)				ST (End of pulsing sequence)
TSPS (Traffic Service Position System)	KP (Prepare for digits)	ST2P (End of pulsing sequence)	ST3P (End of pulsing sequence)	STP (End of pulsing sequence)	ST (End of pulsing sequence
CCITT#5 (shown on display as)	KP1 (Prepare for digits-terminal call) (KP)	KP2 (Prepare for digits-transfer call) (ST2P)	CD11 (Route call to inward operator) (ST3P)	CD12 (Route call to delay operator) (STP)	ST (End of pulsing sequence (ST)
FREQUENCY (HZ) PAIRS	1100 + 1700	1300 + 1700	700 + 1700	900 + 1700	1500 + 1700

Table 4—7. MF Signaling in Coin Control.

FREQUENCIES HZ	FUNCTION	DISPLAY CODE
700 + 1100	Collect	2
1100 + 1700	Return	KP
700 + 1700	Return	ST3P

4.28 OPERATING CONTROLS

4.29 MF/DTMF CONTROL

4.30 The MF/DTMF control selects the tone set recognized by the 2763. At any one time, the 2763 can only monitor MF tones or DTMF tones but not both sets of tones at the same time. If a call begins as a dial pulse call, the 2763 can monitor tones subsequent to detecting dial pulses. Once a KP or a DTMF tone pair has been accepted only tone signals are monitored by the 2763. Table 4—8 briefly summarizes the signaling monitored on any given call.

Table 4—8. Monitored Signaling Per Call.

MF/DTMF CONTROL	DETECTED SIGNALING	SUBSEQUENT SIGNALING MONITORED
MF	DP	DP or MF*
MF	MF	MF only
DTMF	DP	DP or DTMF**
DTMF	DTMF	DTMF only

* Dial pulsing until a valid KP tone pair, then MF tones only . . . dial pulsing data transfers into user memory.
** Dial pulsing until a valid DTMF tone pair, then DTMF tones only . . . dial pulsing data remains on display.

4.31 MINIMUM PULSE WIDTH (MPW) CONTROL

4.32 The MPW control has a continuously adjustable range of approximately 15 msec to 99 msec and a fixed detent position of 40 msec. The 2763 rejects dial pulses and tone pulses lasting less than the MPW control setting.

4.33 The display automatically shows the new MPW control setting whenever the 2763 detects a 2-msec change in MPW control setting. The MPW display persists for about 2 sec after final adjustment of the MPW control.

4.34 During adjustment of the MPW control, a blinking display indicates that the incoming (dial or tone) pulse durations are equal to or exceed the MPW value. This feature can be used to measure the pulse width of dial pulses or tone pulses received. With pulses present, adjust the MPW control to the point where the display just begins to flash . . . the display at this time shows the width of the incoming pulses. None of the data is lost while the display blinks.

4.35 Pressing the DISPLAY control recalls the current MPW control setting. The MPW value remains on the display for about 2 sec after release of the DISPLAY control. Resetting the 2763 also places the current MPW value on the display for about 2 sec if the MPW control is not in the detent position.

4.36 RECEIVE LEVEL CONTROL

4.37 The RECEIVE LEVEL control determines the minimum acceptable amplitude of a tone in a multifrequency (MF or DTMF) signal. The control is continuously variable within a minimum range of − 26 dBm and + 2 dBm. The control has calibration markings in 5-dB increments. A detent position provides for AGC (automatic gain control) operation with a minimum sensitivity of − 26 dBm and a dynamic range of no less than 28 dB.

NOTE

When the RECEIVE LEVEL control is set near the input signal level, then the MPW control setting must be greater than 25 msec. This avoids double detection of a single digit.

4.38 SIGNAL CONV. CONTROL

4.39 With the SIGNAL CONV. control inhibited, the 2763 processes calls in a serial mode. That is, the display shows the current call while the user memory contains data on a previous call if any. (Resetting the 2763 clears both the display and the user memory.) A new call transfers the data from the display into the user memory. The 2763 treats each portion of a CAMA or TSPS call separately. On completion of a CAMA or TSPS call, the user memory holds data concerning the called number and the display shows calling number data.

4.40 Enabling the SIGNAL CONV. control allows the 2763 to monitor operation of tone-to-pulse converters such as:

1. DTMF-to-dial pulse,
2. MF-to-dial pulse,
3. dial pulse-to-MF, or
4. dial pulse-to-DTMF.

4.41 When operating with the SIGNAL CONV. control enabled, data goes directly to user memory . . . data on the display does not transfer to user memory. To monitor a dial pulse-to-DTMF converter the MF/DTMF switch must be set at DTMF. The display shows the DTMF data while the user memory holds dial pulse data.

4.42 To monitor an MF-to-dial pulse or a dial pulse-to MF-converter, the MF/DTMF switch must be set at MF. In this case, dial pulse data goes to the display and the user memory contains the MF data.

4.43 ERROR FUNCTION CONTROL

4.44 With the ERROR FUNCTION control enabled, an error condition exists if:

1. one or more than two MF tones are present,

2. only one DTMF tone is present, or

3. more than 16 dial pulses between interdigital periods have occurred.

4.45 To prevent false error detection due to spurious tones (such as talk-up), the error function does not operate on MF or DTMF signaling until after the 2763 detects and accepts a valid DTMF tone pair or a KP tone pair when monitoring MF signaling. The 2763 ignores MF signaling after detecting a valid ST, STP, ST2P, or ST3P tone pair. Thus, no error detection takes place between the interval of the first ST and the second KP of a CAMA (or TSPS) call.

4.46 The 2763 does not consider a missing key pulse (KP) or start pulse (ST, STP ST2P, ST3P) as an error. The absence of either of these pulses is easily observable on the display.

4.47 A detected error places an "E" symbol on the display. The first error in an MF or DTMF signaling sequence also latches the MF-DTMF frequency content display. Subsequent tone errors simply place additional "E" symbols on the display.

4.48 With the ERROR FUNCTION control disabled, the 2763 ignores and does not record error conditions . . . only valid dial pulses and valid MF or DTMF tone pairs are accepted and shown on the display (or stored in the user memory).

4.49 RESET CONTROL

4.50 Initialization clears the display, the various call status LEDs, and the user memory. The initialization procedure occurs when:

1. power is applied,

2. locally reset, or

3. remotely reset by external equipment or a Model 2765A CDA.

4.51 The RESET control inhibits/enables a remote reset signal to initialize the 2763. The momentary action MAN position resets the 2763 locally. The OUT and IN REMOTE RESET jacks can connect to external equipment for reset by the 2763 or to reset the 2763.

4.52 DISPLAYS AND CALL SEQUENCES

4.53 Figures 4—4 through 4—19 show the displays for various call sequences. Call sequences illustrated include:

1. DTMF call with loop supervision (Figure 4—4),

2. MF call with loop supervision (Figure 4—5),

3. MF calls with E or M supervision (Figures 4—6 and 4—7),

4. DP-MF CAMA calls with loop supervision (Figures 4—8 and 4—9),

5. DP-MF CAMA calls with E or M supervision (Figures 4—10 through 4—13),

6. MF-MF CAMA calls with loop supervision (Figures 4—14 and 4—15), and

7. MF-MF CAMA calls with E or M supervision (Figures 4—16 through 4—19).

4.54 NOTES ON DIAL PULSE OPERATION

4.55 The 2763 considers an off hook at least 60 msec long as a seizure . . . the start of a call. Any data presently on the display enters the user memory.

4.56 Any pulse (break period) present for less than 10 msec is ignored. Any pulse equal to or longer than the MPW control setting counts as one dial pulse.

4.57 The 2763 ignores a transient causing a momentary make period during a dial pulse if the transient lasts for less than one half the MPW control setting and exceeds 20 msec . . . this bridges breaks in a dial pulse.

4.58 A dial pulse stream followed by 260 msec of make (off-hook state during an interdigital period) is accepted as a digit and is displayed. The 2763 ignores all on-hook conditions which may occur between 100 and 250 msec after the start of the interdigital period. This masks out transients between dial pulse digits caused by switching equipment.

4.59 A break period (on hook) of 210 msec or greater indicates the end of a call. All monitoring activities cease until a new seizure is observed. The 2763 is programmed to disregard the "wink disconnect" which may be observed on some E-lead seizure calls.

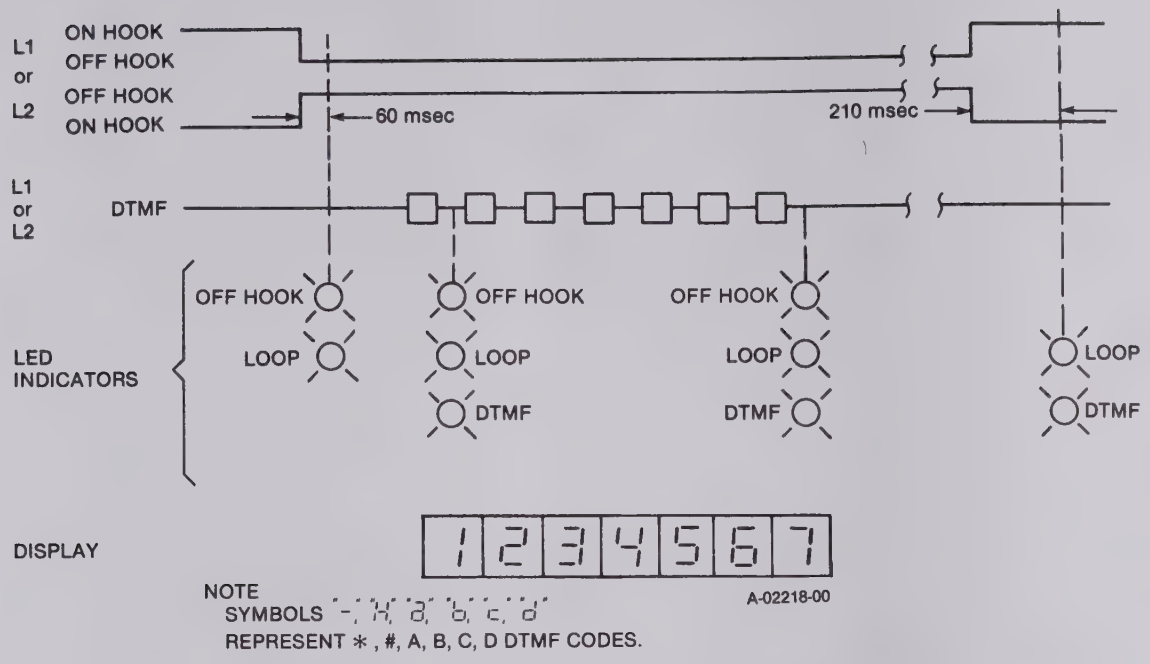


Figure 4—4. DTMF Call with Loop Supervision.

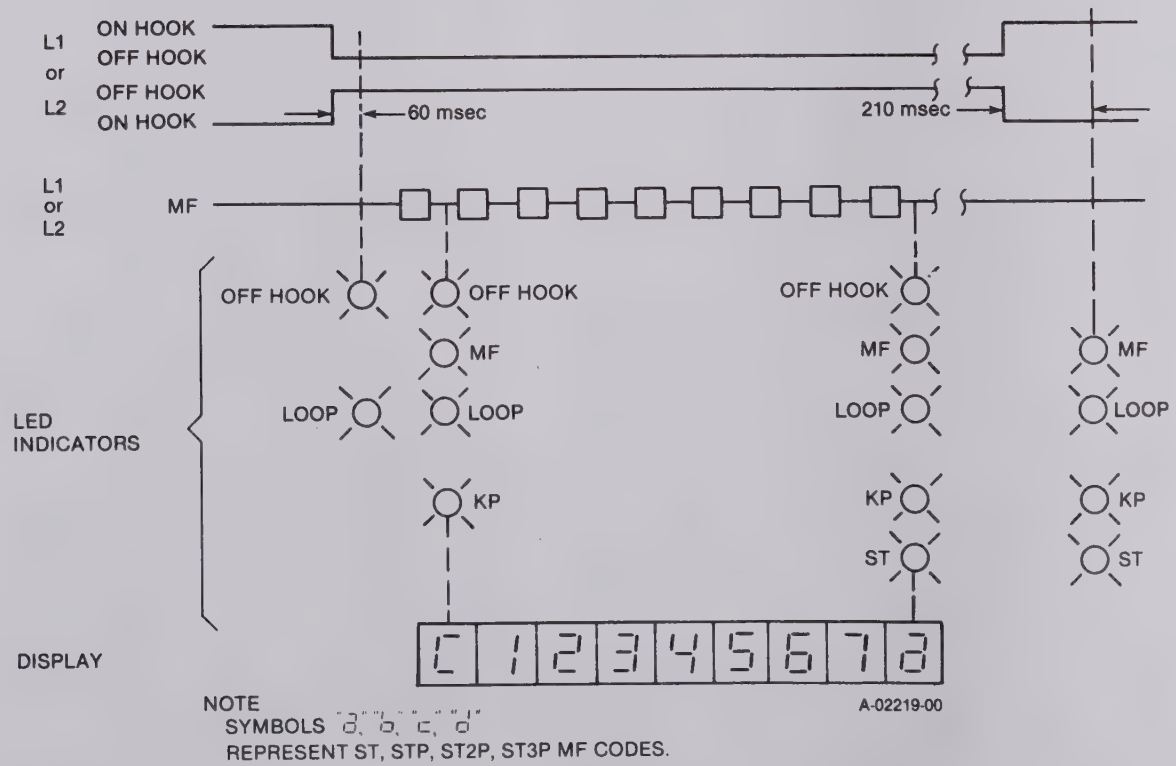


Figure 4—5. MF Call with Loop Supervision.

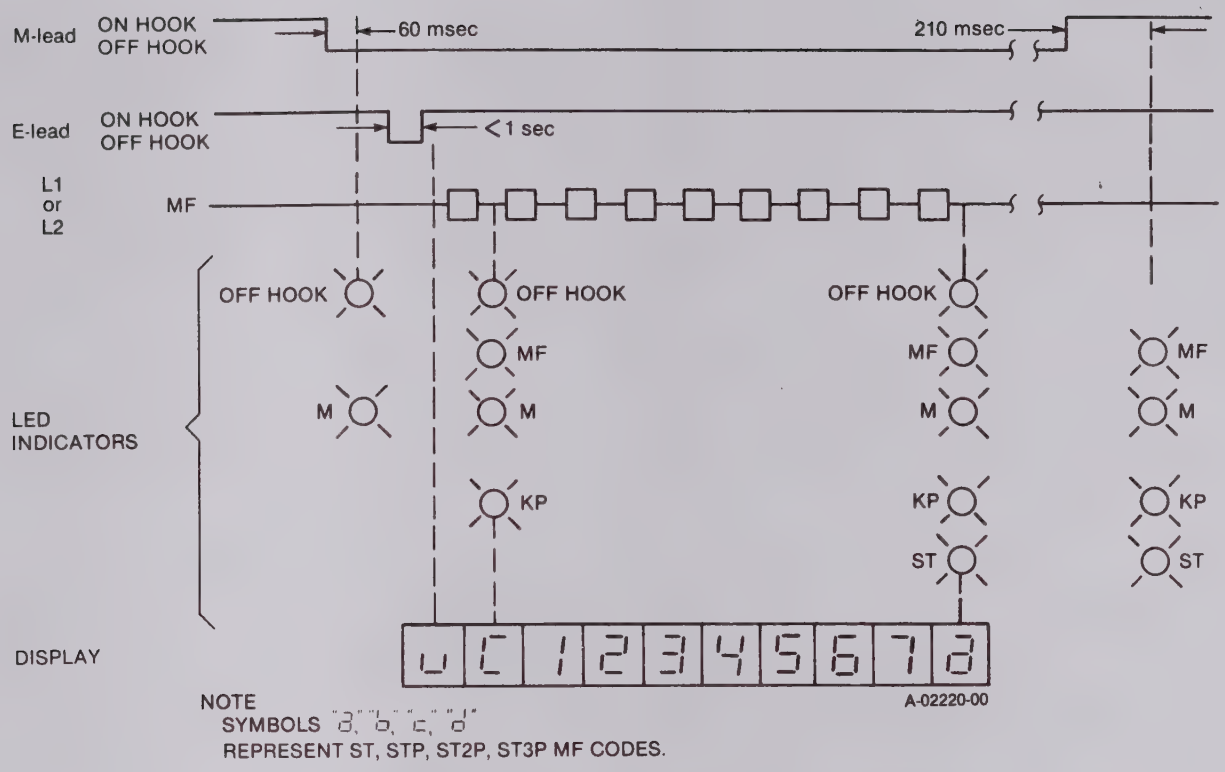


Figure 4—6. MF Call with E&M Supervision (M-Lead Seizure).

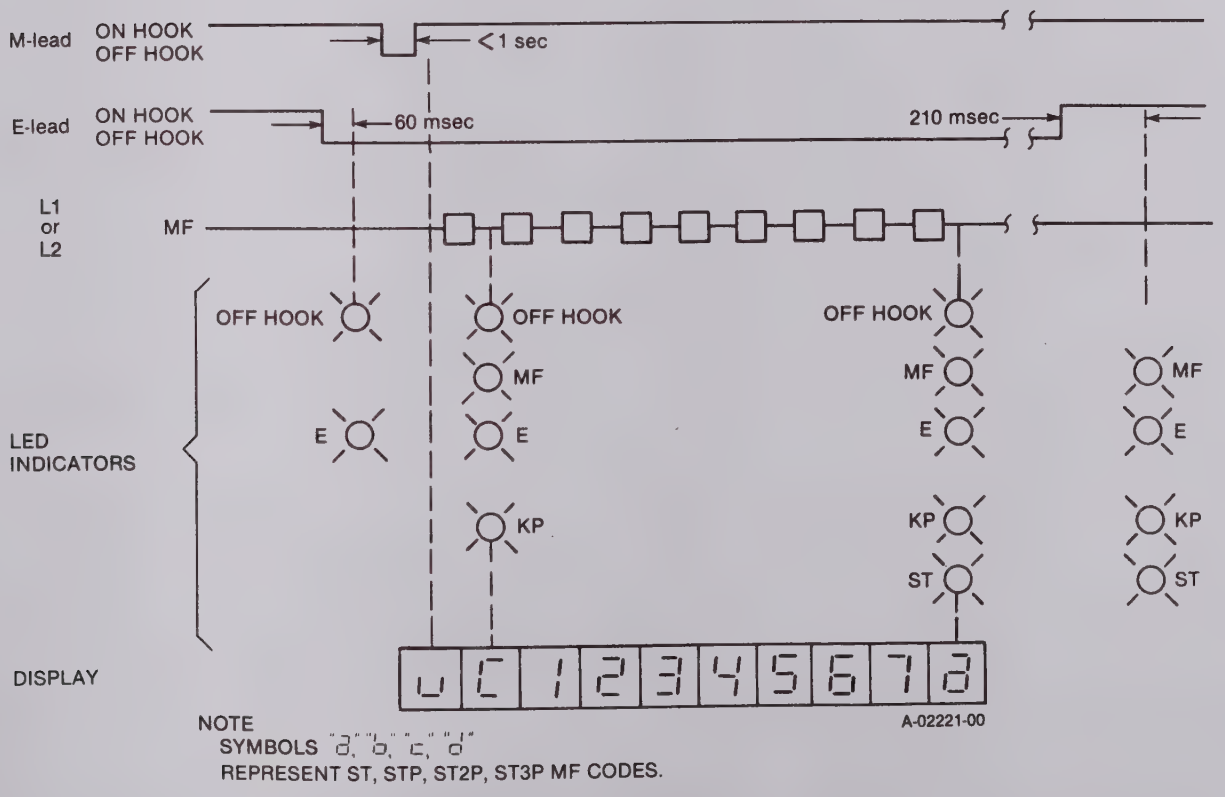
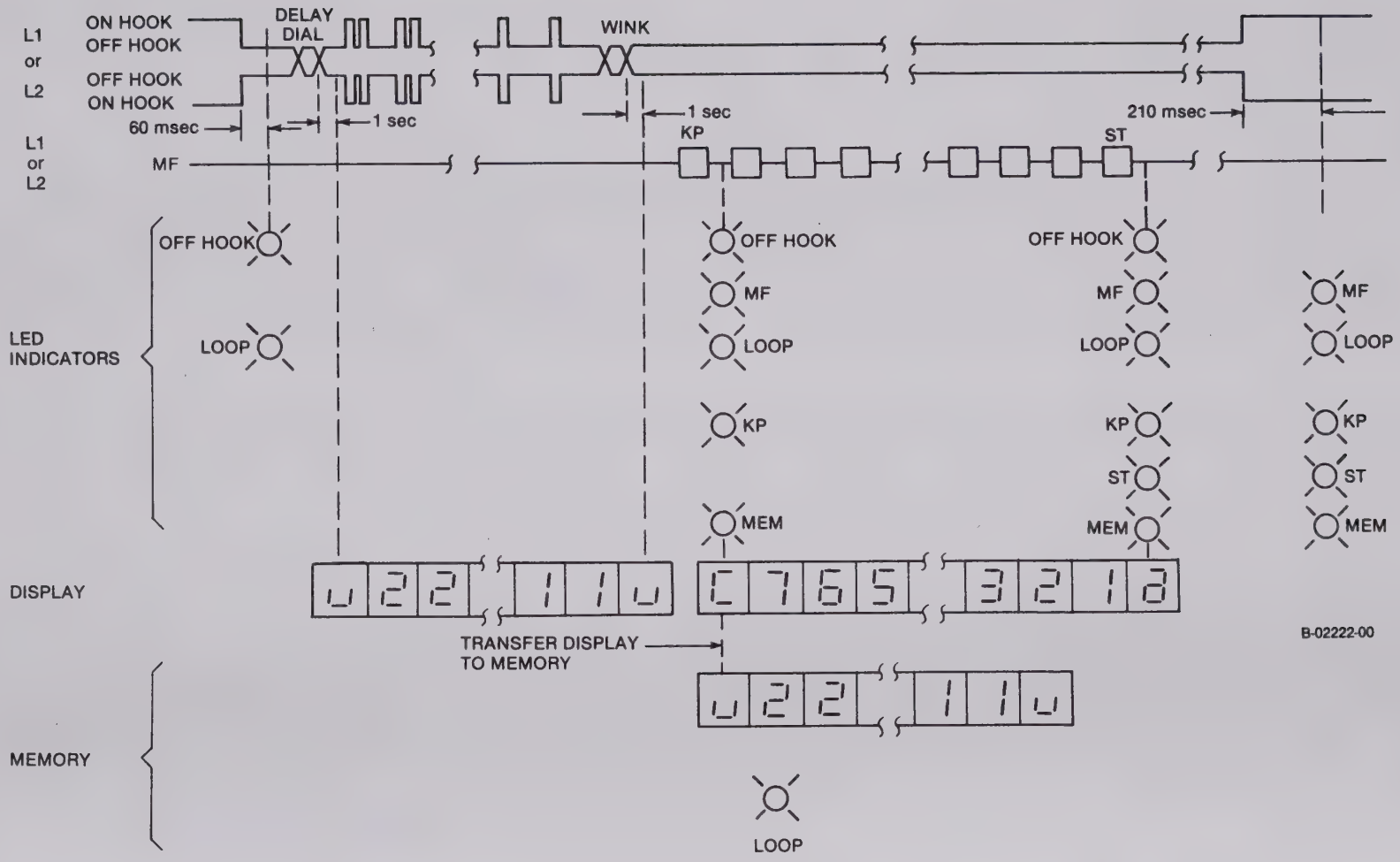
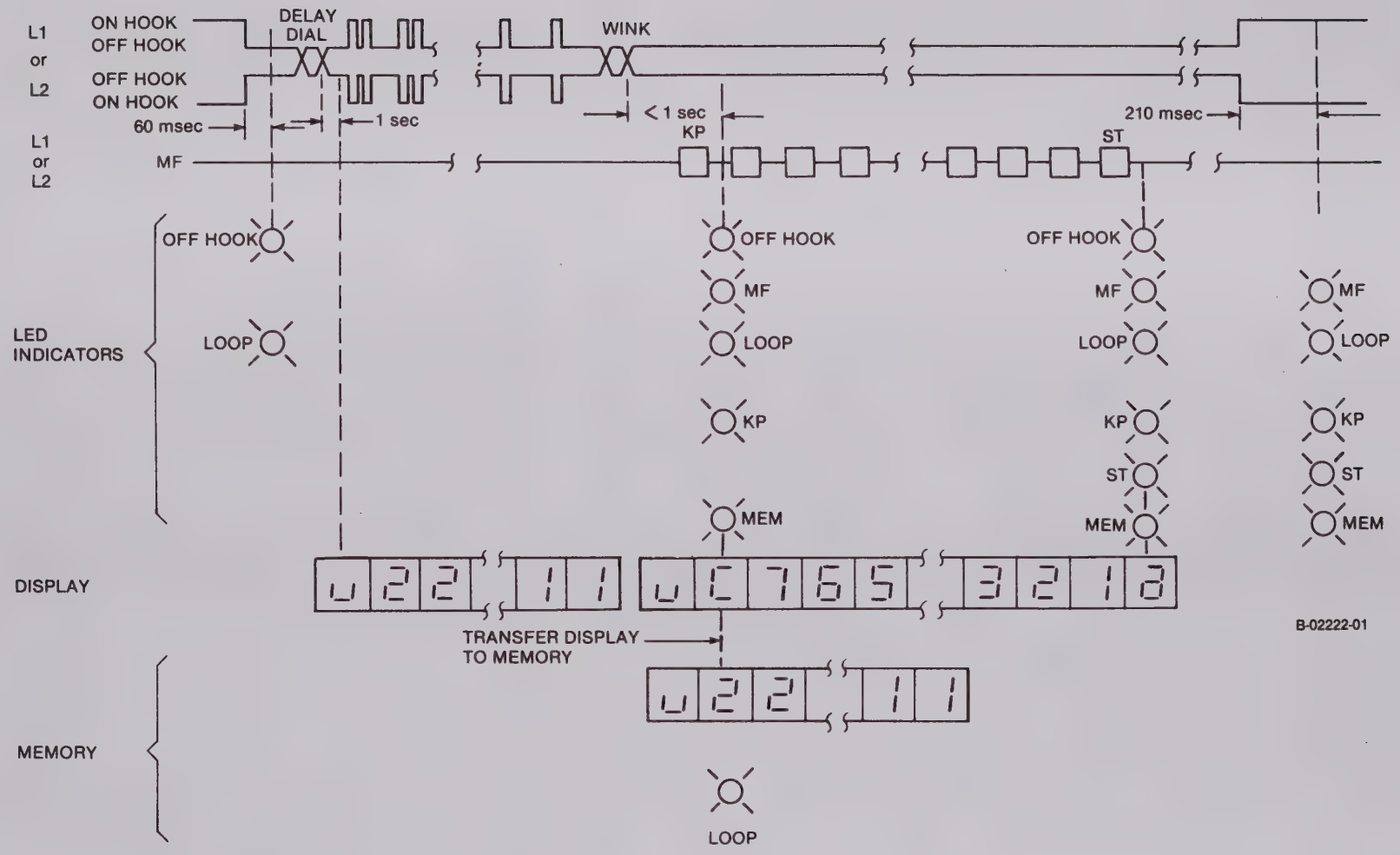


Figure 4—7. MF Call with E&M Supervision (E-Lead Seizure).



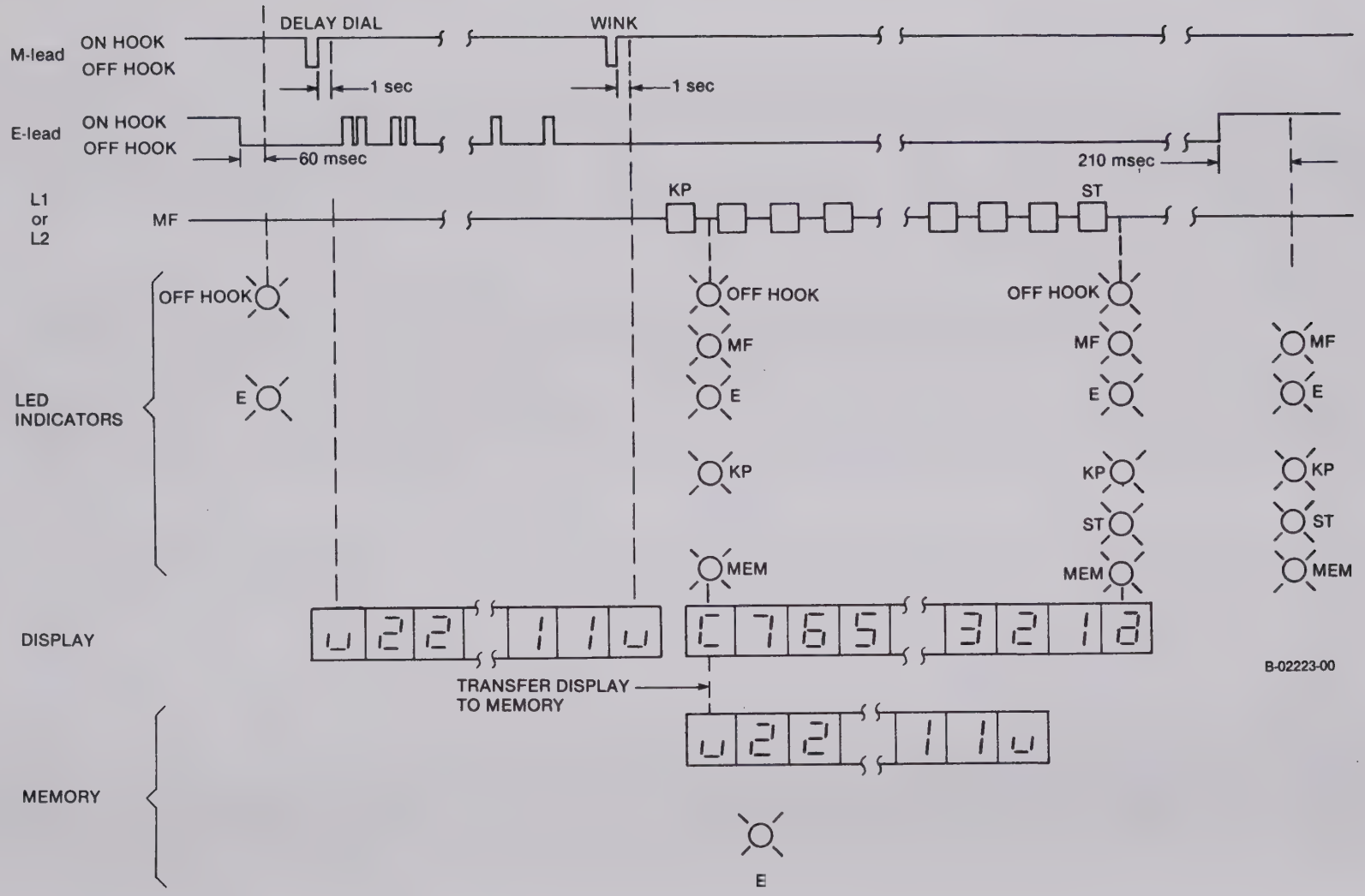
NOTES:
1. SYMBOLS "a", "b", "c", "d" REPRESENT ST, STP, ST2P, ST3P MF CODES.
2. WINK APPEARS WITH **CALLED** NUMBER.

Figure 4—8. DP-MF CAMA Call with Loop Supervision.



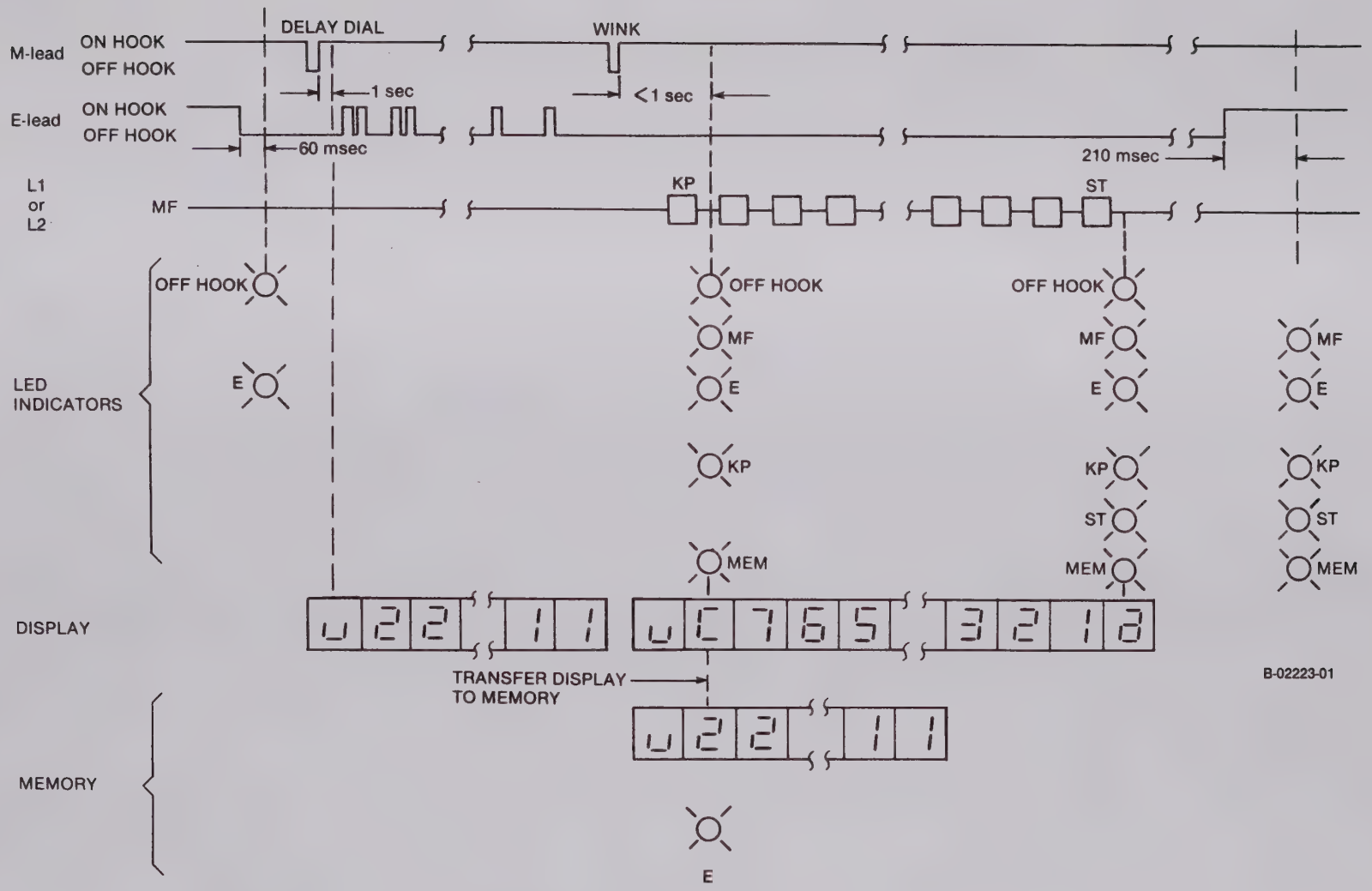
NOTES:
1. SYMBOLS "a", "b", "c", "d" REPRESENT ST, STP, ST2P, ST3P MF CODES.
2. WINK APPEARS WITH **CALLED** NUMBER.

Figure 4—9. DP-MF CAMA Call with Loop Supervision.



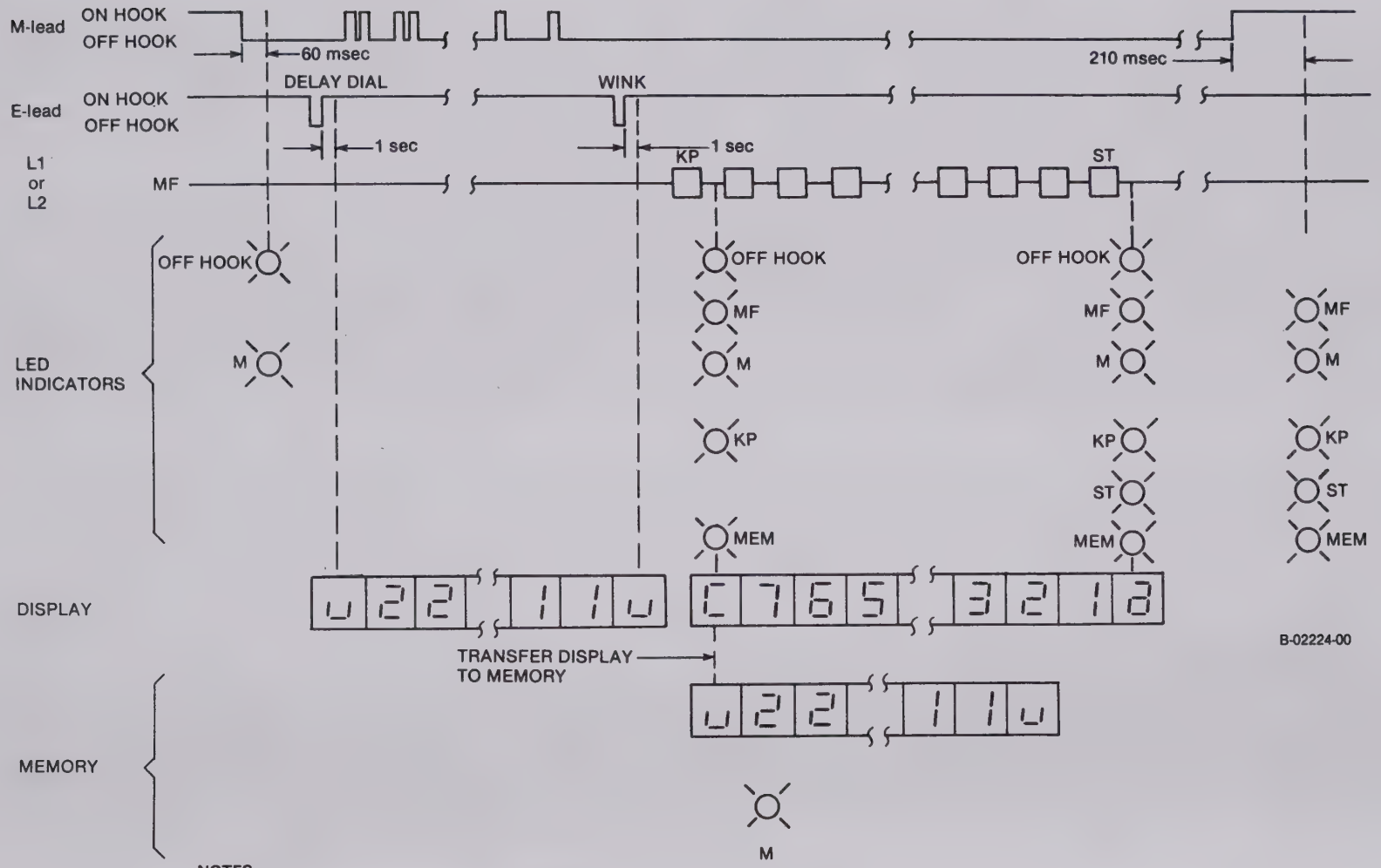
NOTES:
1. SYMBOLS "a", "b", "c", "d" REPRESENT ST, STP, ST2P, ST3P MF CODES.
2. WINK APPEARS WITH **CALLED** NUMBER.

Figure 4—10. DP-MF CAMA Call with E&M Supervision (E-Lead Seizure).



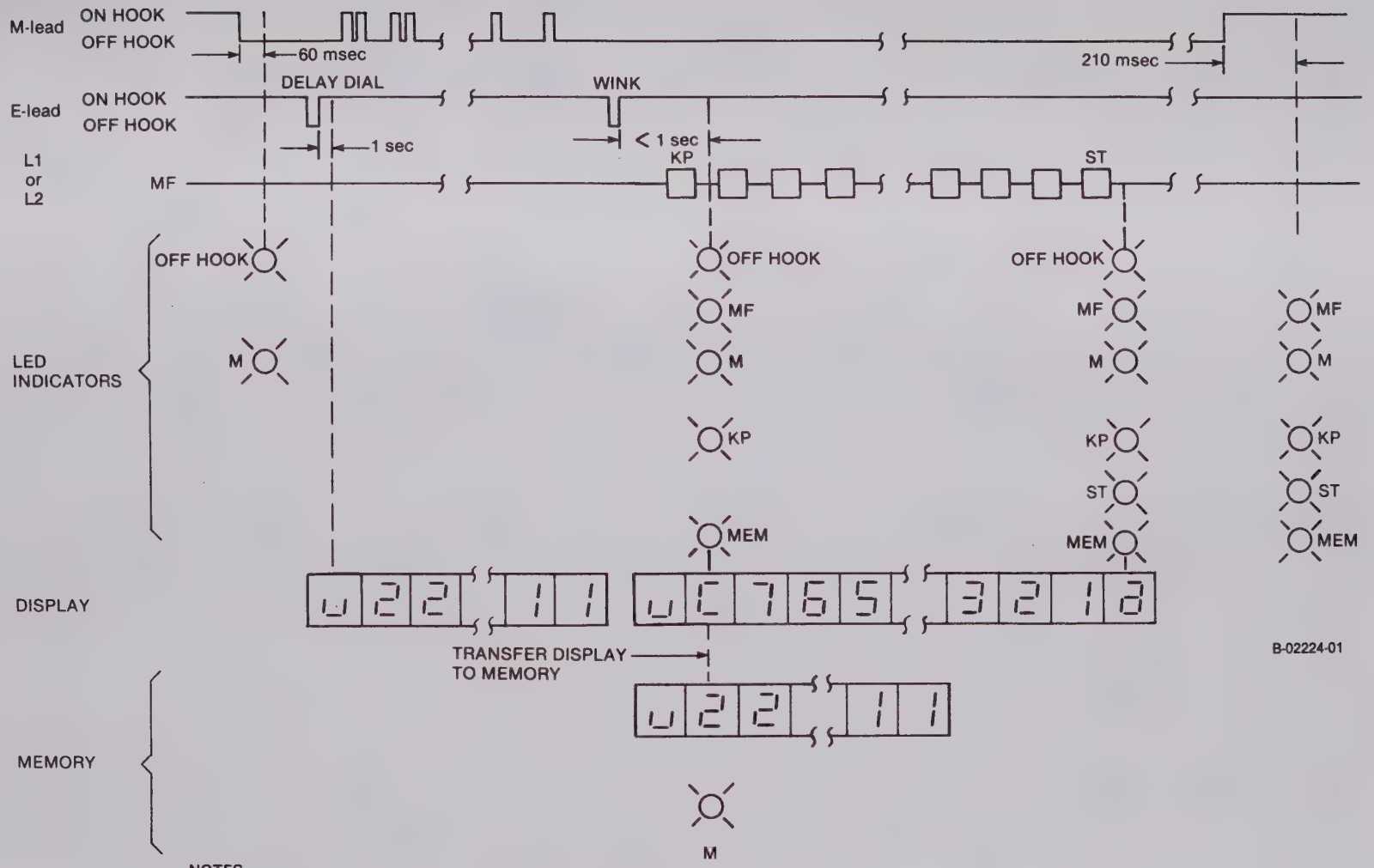
NOTES:
1. SYMBOLS "a", "b", "c", "d" REPRESENT ST, STP, ST2P, ST3P MF CODES.
2. WINK APPEARS WITH **CALLED** NUMBER.

Figure 4—11. DP-MF CAMA Call with E&M Supervision (E-Lead Seizure).



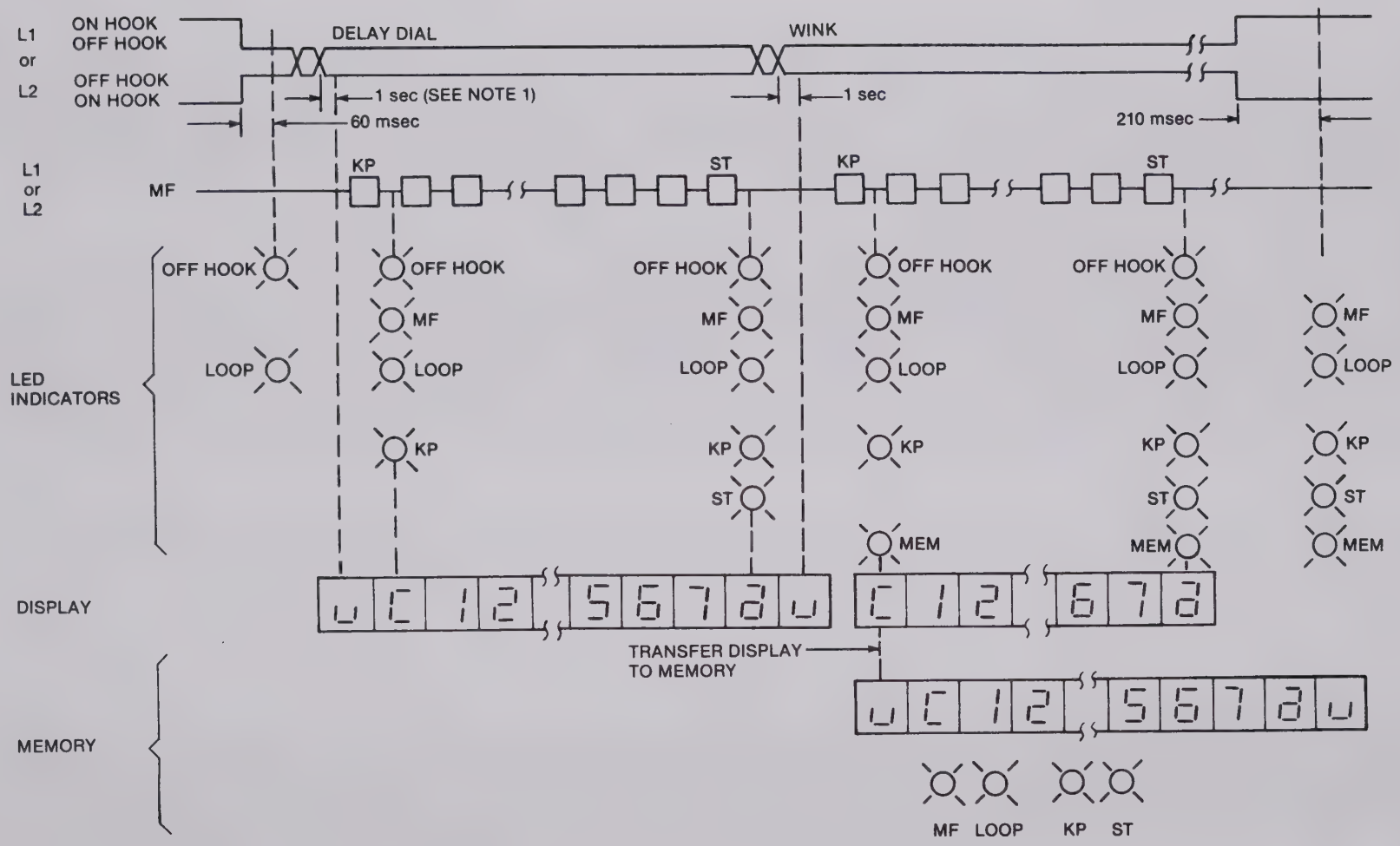
NOTES:
1. SYMBOLS "a", "b", "c", "d" REPRESENT ST, STP, ST2P, ST3P MF CODES.
2. WINK APPEARS WITH **CALLED** NUMBER.

Figure 4—12. DP-MF CAMA Call with E&M Supervision (M-Lead Seizure).



NOTES:
1. SYMBOLS "a", "b", "c", "d" REPRESENT ST, STP, ST2P, ST3P MF CODES.
2. WINK APPEARS WITH **CALLED** NUMBER.

Figure 4—13. DP-MF CAMA Call with E&M Supervision (M-Lead Seizure).



NOTES
1. "ᵤ" IS PLACED IN THE DISPLAY ONE SECOND AFTER DELAY DIAL OR AT THE SAME TIME WITH KP IF KP ARRIVES WITHIN ONE SECOND AFTER DELAY DIAL.
2. SYMBOLS "ₐ", "ᵦ", "꜀", "ₔ" REPRESENT ST, STP, ST2P, ST3P MF CODES.
3. WINK APPEARS WITH **CALLING** NUMBER.

B-02225-00

Figure 4—14. MF-MF CAMA Call with Loop Supervision.

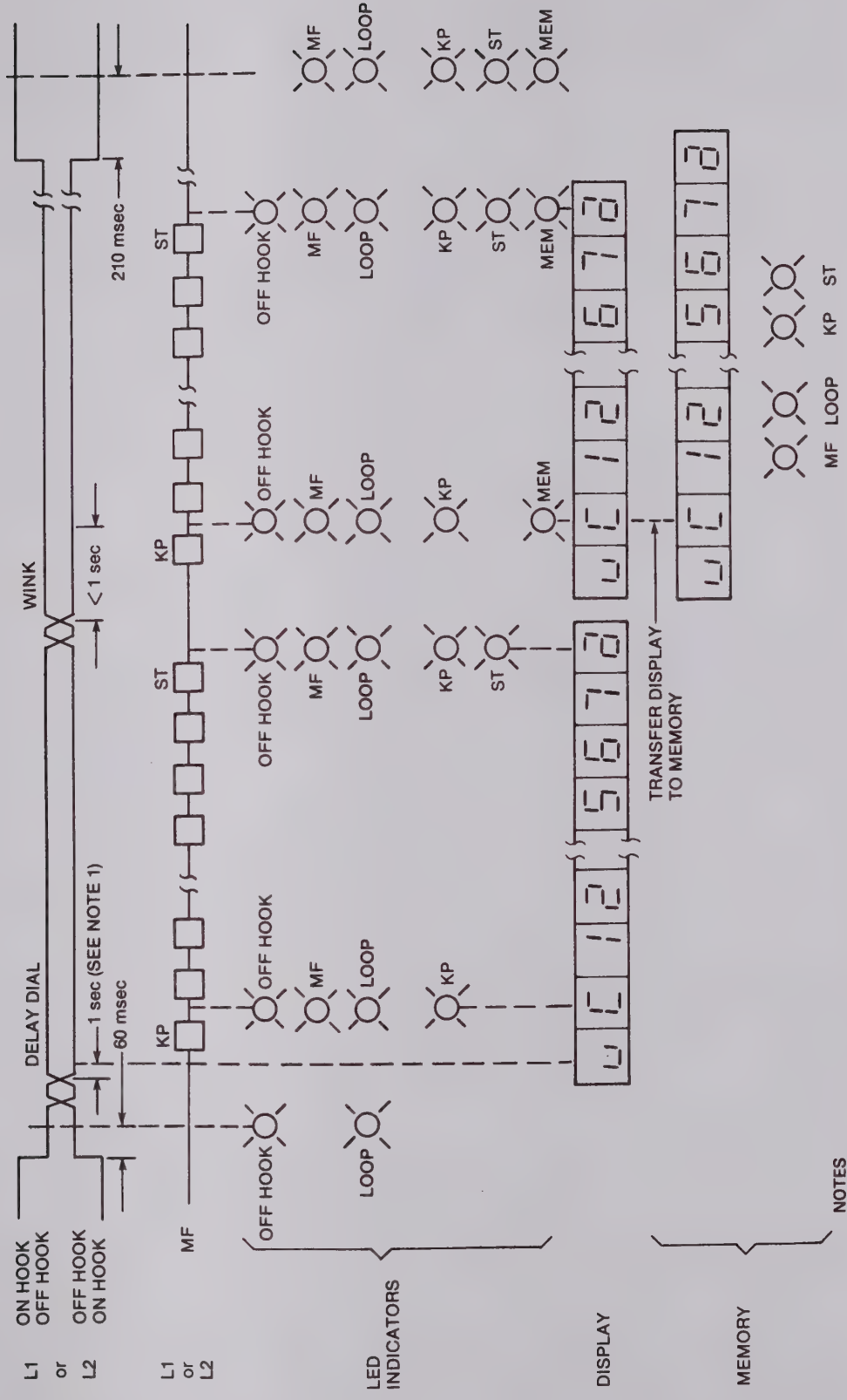
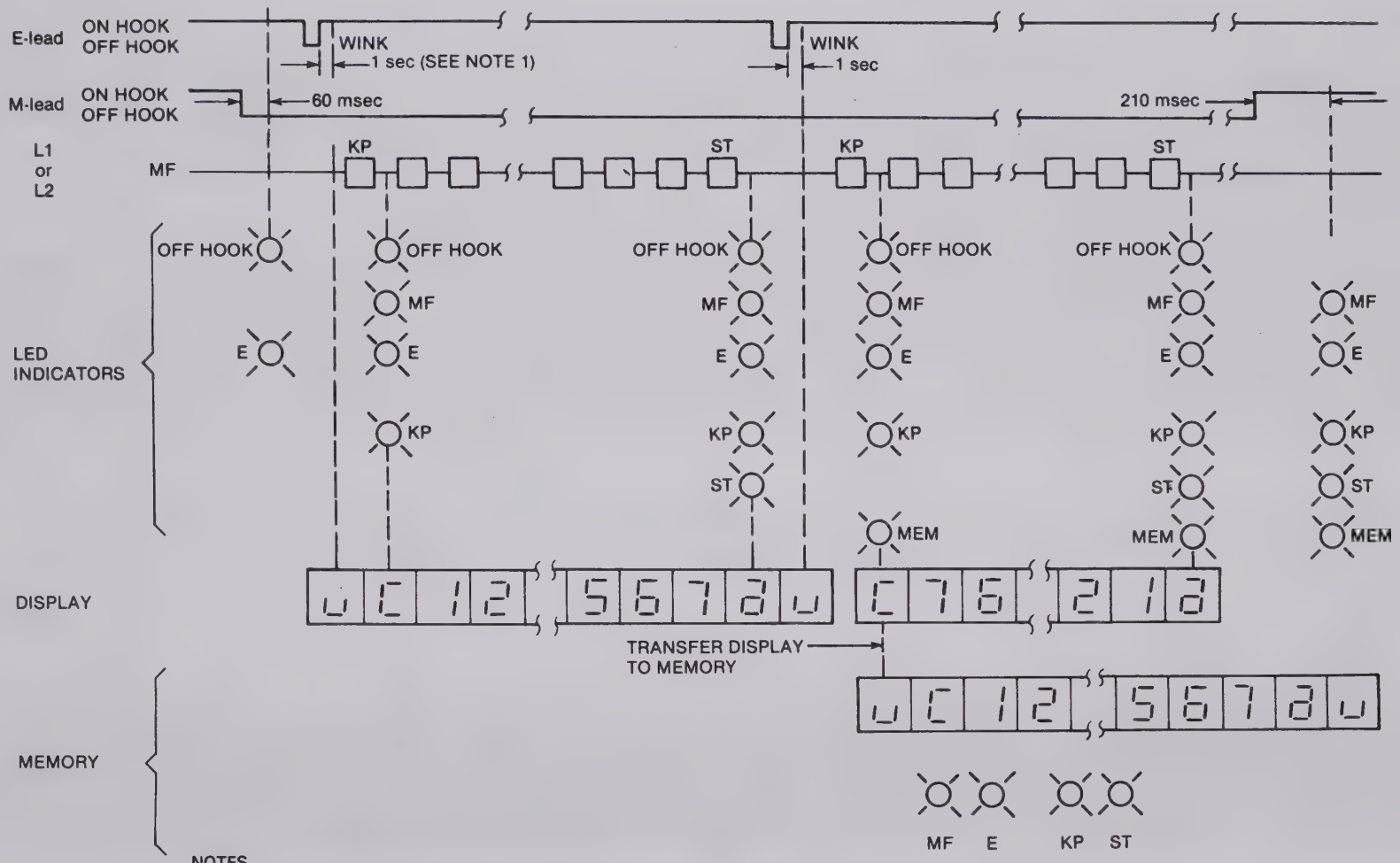
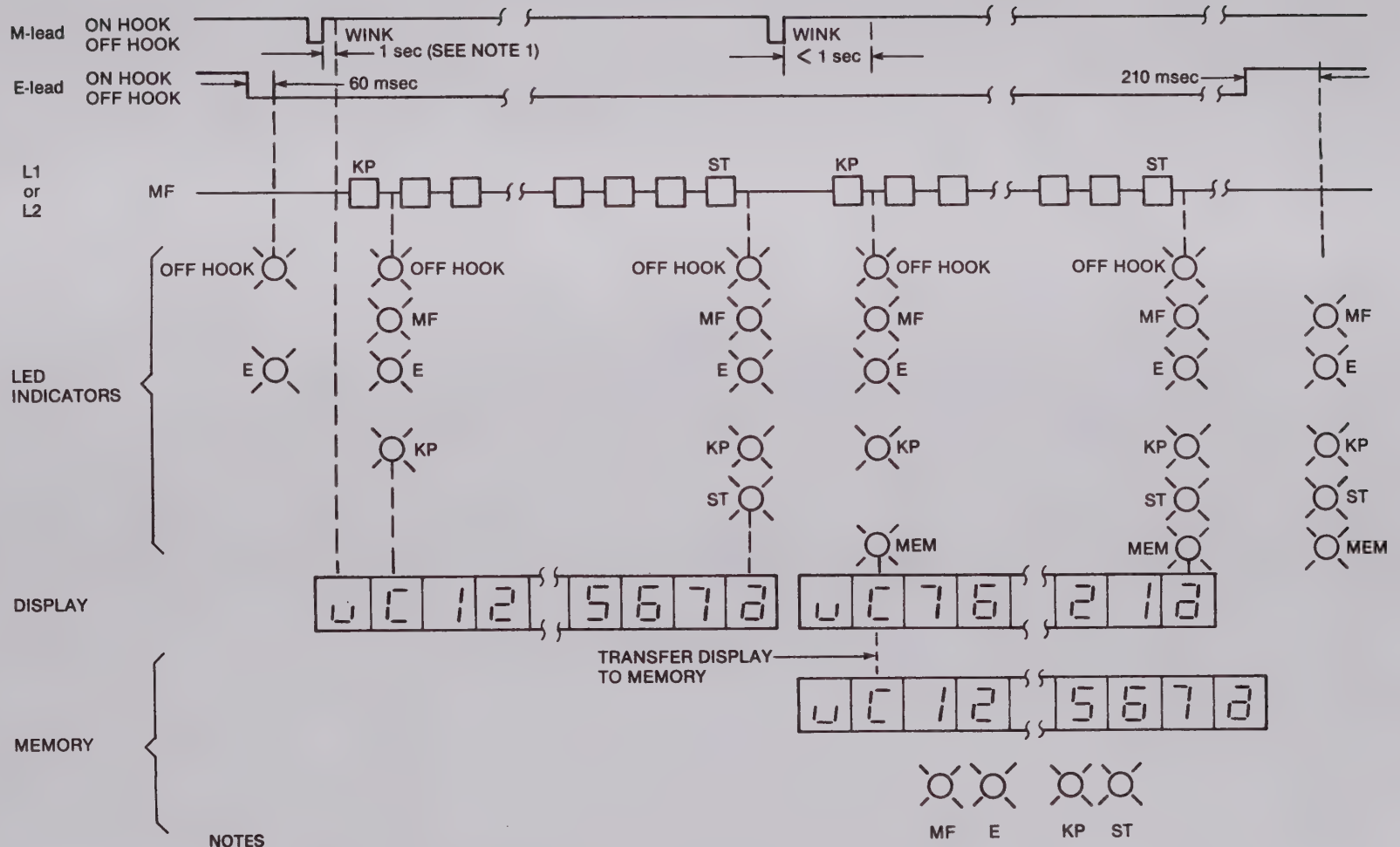


Figure 4—15. MF-MF CAMA Call with Loop Supervision.



NOTES
1. "ᵕ" IS PLACED IN THE DISPLAY ONE SECOND AFTER DELAY DIAL OR AT THE SAME TIME WITH KP IF KP ARRIVES WITHIN ONE SECOND AFTER DELAY DIAL.
2. SYMBOLS "a", "b", "c", "d" REPRESENT ST, STP, ST2P, ST3P MF CODES.
3. WINK APPEARS WITH **CALLING** NUMBER.

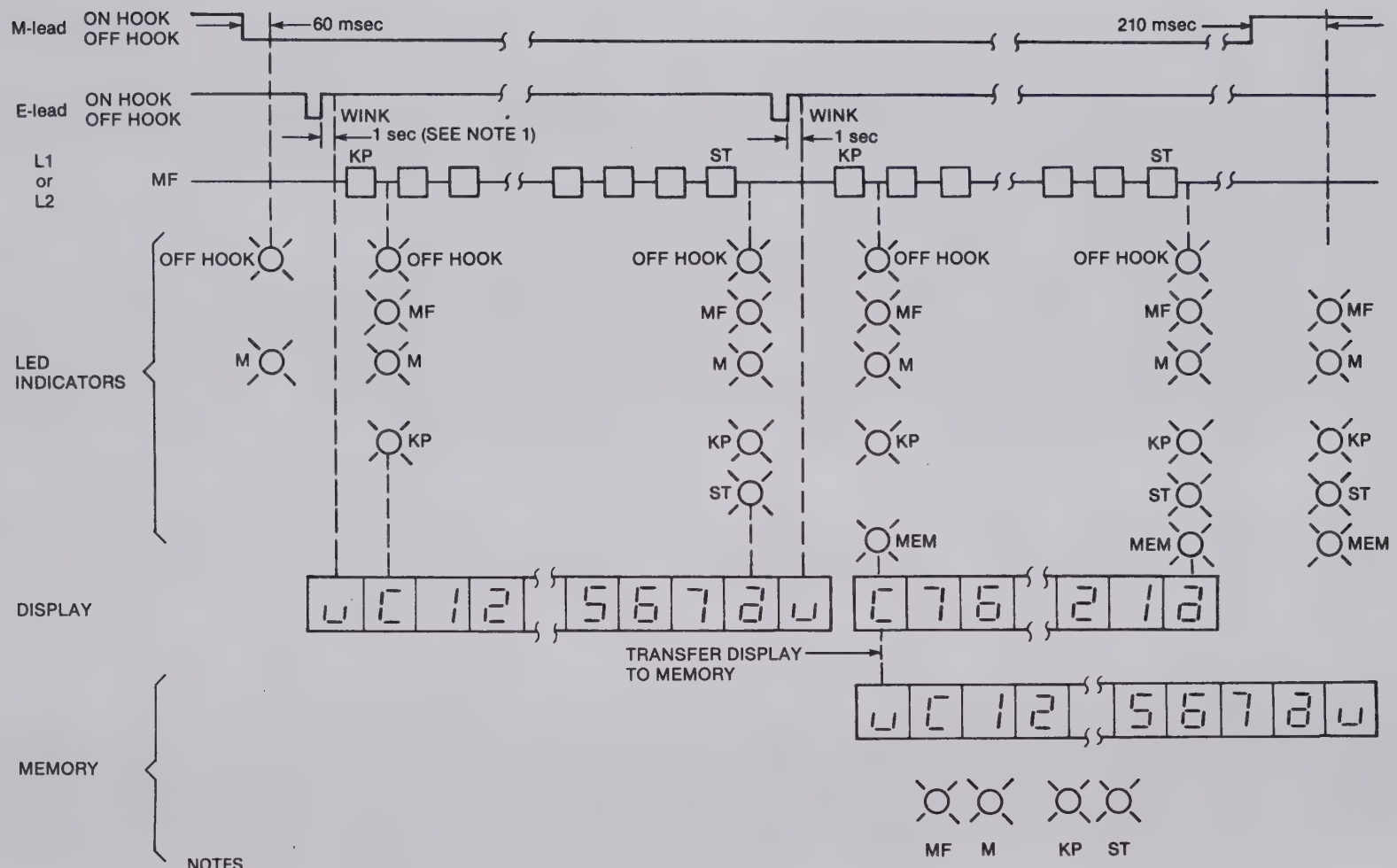
Figure 4—16. MF-MF CAMA Call with E&M Supervision (E-Lead Seizure).



NOTES
1. "ᵕ" IS PLACED IN THE DISPLAY ONE SECOND AFTER DELAY DIAL OR AT THE SAME TIME WITH KP IF KP ARRIVES WITHIN ONE SECOND AFTER DELAY DIAL.
2. SYMBOLS "a", "b", "c", "d" REPRESENT ST, STP, ST2P, ST3P MF CODES.
3. WINK APPEARS WITH **CALLING** NUMBER.

B-02226-01

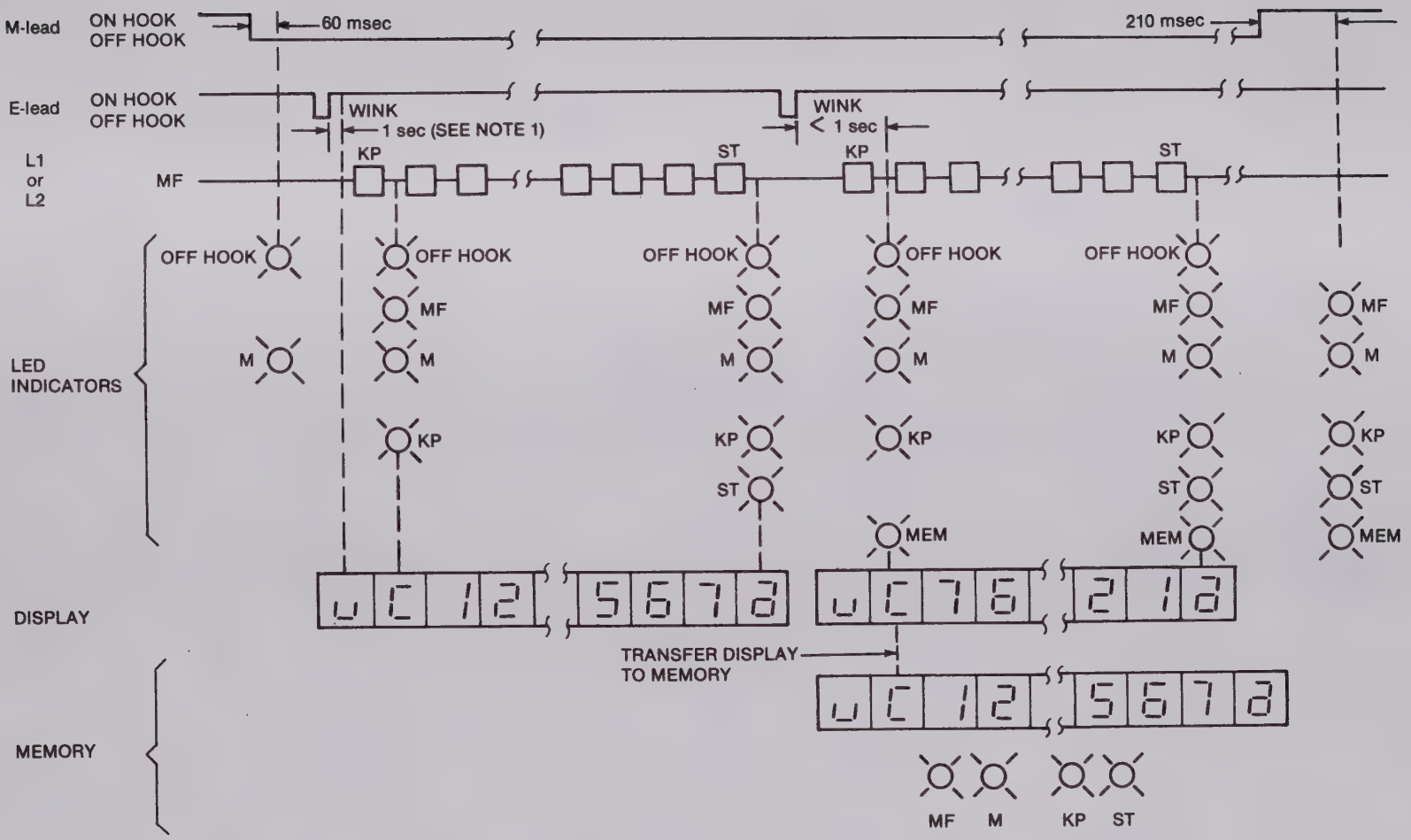
Figure 4—17. MF-MF CAMA Call with E&M Supervision (E-Lead Seizure).



NOTES
1. "␣" IS PLACED IN THE DISPLAY ONE SECOND AFTER DELAY DIAL OR AT THE SAME TIME WITH KP IF KP ARRIVES WITHIN ONE SECOND AFTER DELAY DIAL.
2. SYMBOLS "a", "b", "c", "d" REPRESENT ST, STP, ST2P, ST3P MF CODES.
3. WINK APPEARS WITH **CALLING** NUMBER.

B-02227-00

Figure 4—18. MF-MF CAMA Call with E&M Supervision (M-Lead Seizure).



NOTES
1. "u" IS PLACED IN THE DISPLAY ONE SECOND AFTER DELAY DIAL OR AT THE SAME TIME WITH KP IF KP ARRIVES WITHIN ONE SECOND AFTER DELAY DIAL.
2. SYMBOLS "a", "b", "c", "d" REPRESENT ST, STP, ST2P, ST3P MF CODES.
3. WINK APPEARS WITH **CALLING** NUMBER.

B-02227-01

Figure 4—19. MF-MF CAMA Call with E&M Supervision (M-Lead Seizure).

4.60 When the number of dial pulses between interdigital periods exceeds 10, the display shows " , , , , , " for 11, 12, 13, 14, 15, 16 dial pulses respectively. Should the number of dial pulses exceed 16, an "E" appears on the display if the ERROR FUNCTION is enabled, otherwise the dial pulse stream is ignored.

NOTE

The 2763 indicates a continuous off hook on ground start loop circuits regardless of the actual line condition

4.61 NOTES ON DTMF OPERATION WITH ERROR FUNCTION DISABLED

4.62 An off hook at least 60 msec long indicates a seizure. The data presently on the display enters the user memory.

4.63 The 2763 detects and accepts dual 1-of-4 (also referred to as 2-of-8) DTMF tones if they coincide for a minimum period equal to the MPW control setting and if the compound level exceeds the RECEIVE LEVEL threshold control setting. The 2763 rejects any tone pair if the twist exceeds 15 ± 2 dB when the RECEIVE LEVEL control is set at AGC.

NOTE

The 2763 can monitor DTMF signaling in the absence of supervision (dry loop).

4.64 Any DTMF tone pair detected and accepted as valid appears on the display . . . even with the SIGNAL CONV. control enabled.

4.65 NOTES ON DTMF OPERATION WITH ERROR FUNCTION ENABLED

4.66 After the first DTMF tone pair has been detected and accepted, the 2763 considers as an error a single frequency tone in either the low group or the high group lasting for at least the MPW control setting. When an error is detected, the 2763 latches the MF-DTMF frequency content display and places an "E" on the display. Only an "E" appears on the display for subsequent detected errors.

4.67 Only the frequency or frequencies detected during the first period equal to the MPW control setting are recognized and evaluated. The 2763 ignores all changes in tone frequencies during an uninterrupted "tone present" interval following detection and acceptance of a DTMF tone pair. The DTMF detection circuit requires that all tones end before placing DTMF data on the display . . . the MF-DTMF frequency content display shows the tones as they are detected until latched by the first error.

4.68 Should a DTMF signal consist of three tones . . . one tone from one group (high or low) and the other two tones from the second group (low or high), then the frequency content display shows only the tone frequency of the group with only one tone present. The 2763 ignores the portion of a DTMF signal consisting of two or more frequencies from the same group.

4.69 NOTES ON MF OPERATION WITH ERROR FUNCTION DISABLED

4.70 The 2763 detects and accepts 2-of-6 MF tone pairs if the tones coincide for a minimum period equal to the MPW control setting and if the compound level exceeds the RECEIVE LEVEL threshold control setting. The 2763 rejects any tone pair if the twist is greater than 15 ± 2 dB when the RECEIVE LEVEL threshold control is set at AGC. MF signals may be monitored with or without dc supervision present.

4.71 The 2763 interprets a valid KP following a seizure as the start of the called number pulsing sequence. A second KP following a seizure is normally associated with the calling number. A valid KP not preceded by a seizure transfers the data presently on the display into the user display. A start pulse (ST, STP, ST2P, or ST3P) indicates the end of the pulsing sequence. The 2763 ignores all MF signaling until a valid KP tone pair is detected.

4.72 An MF tone pair detected and accepted as valid appears on the display but the MF data goes directly to the user memory when the SIGNAL CONV. control is enabled.

4.73 The display shows symbol " " for a KP. Symbols " ", " ", " ", and " " represent ST, STP, ST2P, and ST3P respectively. A set of LEDs associated with the KP and ST signals turn on to indicate the reception of these MF tone pairs.

4.74 NOTES ON MF OPERATION WITH ERROR FUNCTION ENABLED

4.75 The 2763 does not consider any MF signaling error to have occurred until after having accepted a KP tone pair . . . this prevents false error detection due to talk-up. An MF signaling error occurs if:

1. only one MF tone or more than two MF tones are present . . . each tone lasting for a minimum period equal to the MPW control setting, or

2. an MF tone pair has a skew greater than 8 ± 2 msec and the tones coincided for a minimum period equal to the MPW control setting. Skew (or compound frequency tolerance) refers to the difference between the

start time of the tones in an MF tone pair. The 2763 does not check the skew of a KP tone pair at any time.

4.76 Upon detection of an MF signaling error, an "E" appears on the display (or the "E" goes into the user memory if SIGNAL CONV. control is enabled) and the MF-DTMF frequency displays latch up. Subsequent errors only cause additional "E"s to appear on the display . . . the frequency content is not shown. Note that an error due to skew latches two indicators on the frequency content display, otherwise one or more than two indicators are latched on . . . one for each frequency contained in the erroneous MF signal.

4.77 BACKWARD SIGNALING AND DISPLAY

4.78 Backward signals for loop supervision are transmitted by the called end via battery reversals. For E&M supervision, backward signaling travels on the non-seized lead . . .the E-lead if seizure occurred on the M-lead or vice versa. The 2763 evaluates the backward signaling by observing the change of states (battery reversal for loop supervision, on/off hook for E&M supervision) and timing the interval between change of states (also referred to as transitions).

4.79 Three symbols distinguish various types of backward signals.

1. A " " indicates a battery loop reversal sequence (normal-reverse-normal) or E&M off-hook sequence (on-off-on) that took longer than one second between transitions. In addition, no digits (either dialing or tone pulsing) were received between the transitions.

2. A " " indicates a battery loop reversal or E&M off-hook sequence that lasted longer than 100 msec but less than one second . . . such as a delay dialing signal or a wink signal.

3. A " " indicates a single transition.

4.80 Figure 4—20 illustrates various backward signaling conditions. The backward signaling is monitored for a single input port. This means that if seizure was detected on input port L1, then the 2763 monitors backward signaling on that input port only and ignores the backward signaling on the other input ports. Similarly, a call initiated by an E-lead seizure instructs the 2763 to monitor backward signaling on the M-lead only.

4.81 The transitions are individually recorded and are associated with a specific call.

1. Wink lasting less than one second or a single transition following a digit or start pulse (ST, STP, ST2P, ST3P) is associated with the second call (or second half of a CAMA call) if it is in turn followed by a digit or a key pulse (KP) within one second.

2. Wink signal, or a single transition **not** followed by a digit or other valid code within one second is associated with the present call.

3. A transition state lasting longer than one second is associated with the call in progress.

4.82 OPERATION UNDER ABNORMAL CONDITIONS

4.83 In most instances, the 2763 has sufficient storage to hold all the data on a call . . . up to 32 signaling events if the SIGNAL CONV. function is inhibited, otherwise up to 16 signaling events each in the display buffer and in the user memory buffer.

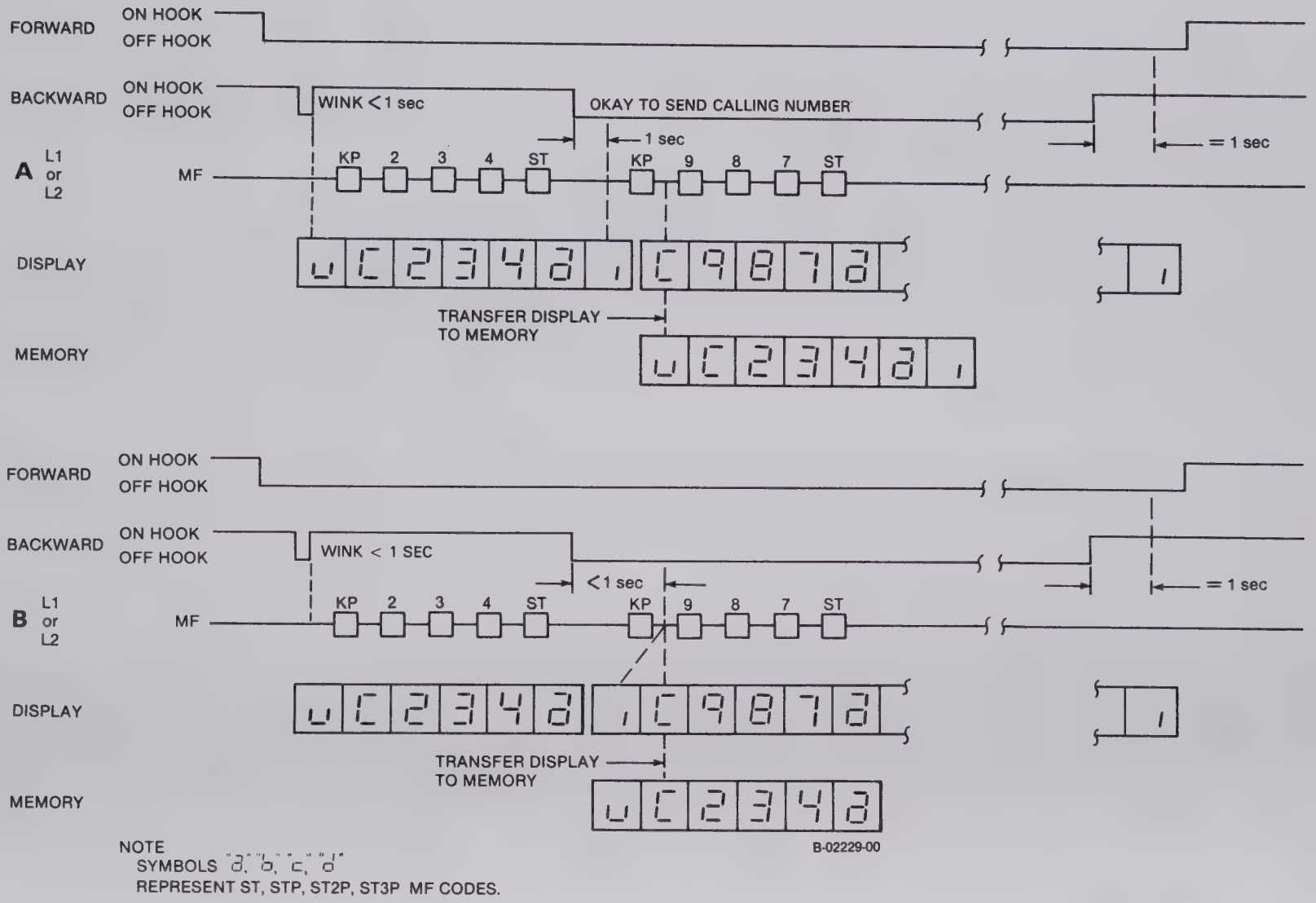
4.84 With the SIGNAL CONV. function inhibited, the display and user memory buffers together can store up to 32 signaling events (backward supervision and dialed digit codes). Once the buffers fill up, no more data can be stored . . . thus, in effect, the 2763 stops all monitoring activities. The 2763 remains in this state until cleared by a new call or reset either manually or remotely. Table 4—9 lists the non-monitoring conditions for various types of calls. Note that for CAMA ANI and TSPS calls, the 2763 retains data which caused the non-monitoring conditions.

4.85 With the SIGNAL CONV. function enabled, the display buffer and the user memory buffer each can store up to 16 signaling events. Once a buffer fills, then that buffer stops storing data . . . the other buffer continues to store data. Should the display buffer fill up, the 2763 ceases to monitor supervision. The 2763 stops monitoring completely when both buffers are filled with data. The 2763 must be cleared by a new call, a remote reset, or a manual reset.

4.86 DIAGNOSTIC OPERATION IN DIAL PULSE SYSTEMS

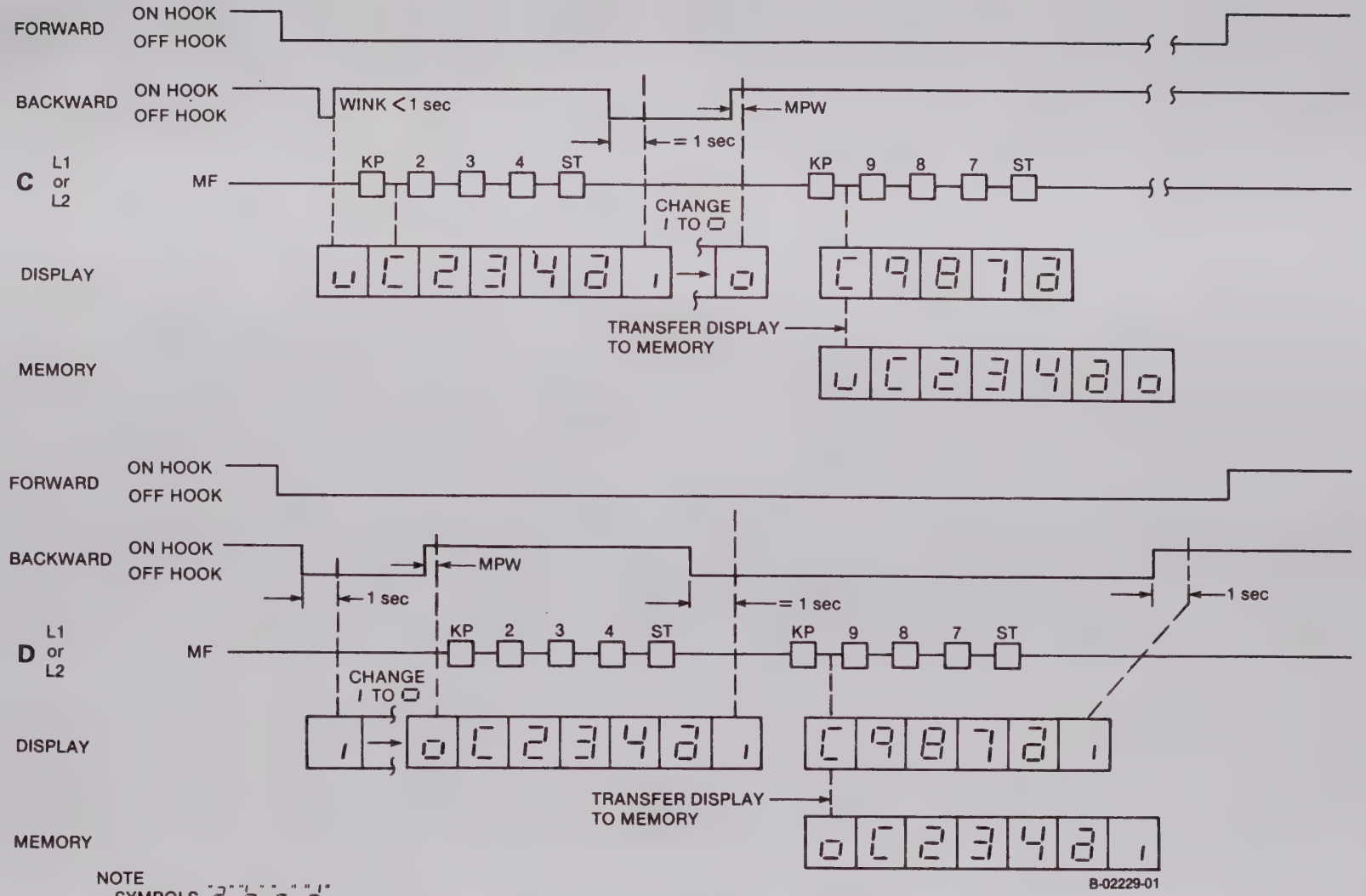
4.87 The 2763 can be helpful in troubleshooting marginal or inoperative dial pulse systems. The line under observation is assumed to be out of service so that a known sequence of dial pulses can be transmitted at machine or manual rates.

4.88 If signaling errors appear in the system, the 2763 can be used to detect whether too few pulses for a known digit are being transmitted, or if the length of the transmitted pulses have too short a duration (pulse width, on-hook or break interval).



NOTE
SYMBOLS "a", "b", "c", "d"
REPRESENT ST, STP, ST2P, ST3P MF CODES.

Figure 4—20. Displays for Backward Signaling on E&M (Sheet 1 of 2).



NOTE
SYMBOLS "a," "b," "c," "d"
REPRESENT ST, STP, ST2P, ST3P MF CODES.

Figure 4—20. Displays for Backward Signaling on E&M (Sheet 2 of 2).

Table 4—9. Data Transfer and Non-Monitor Conditions.

SIGNALING CONVERTER FUNCTION DISABLED	
TYPE OF CALL	**DESCRIPTION**
DTMF	Up to 32 signaling events (DTMF codes and backward supervision). The 2763 transfers the data concerning the first 16 signaling events from the display to the user memory on the 17th signaling event and stops monitoring on the 32nd signaling event.
DP	Up to 32 signaling events (dialed digits and backward supervision). The 2763 transfers the data concerning the first 16 signaling events from the display to the user memory on the 17th signaling event and stops monitoring on the 32nd signaling event.
MF	Up to 32 signaling events (MF codes and backward supervision). The 2763 transfers the data concerning the first 16 signaling events from the display to the user memory on the 17th signaling event and stops monitoring on the 32nd signaling event.
DP-MF (CAMA ANI or TSPS calls)	Up to 32 signaling events (dialed digits, MF codes, and backward supervision). The 2763 transfers data from the display to user memory on: 1. the 17th signaling event during the DP portion of the call, 2. the detection of key pulse (KP) . . . losing some data if the DP portion of the call had more than 17 signaling events, or 3. the 17th signaling event during the MF portion of the call . . . losing the data (or the remainder of the data) on the DP portion of the call. The 2763 stops monitoring on the 32nd signaling event during either the DP or MF portion of the call.
MF-MF(CAMA ANI or TSPS calls)	Up to 32 signaling events (MF codes and backward supervision). The 2763 transfers data from the display to user memory on: 1. the 17th signaling event during the first MF portion of the call, 2. the detection of key pulse (KP) from the second MF portion of the call after a start pulse (ST, STP, ST2P, ST3P) . . . losing some data if the first MF portion of the call had more than 17 signaling events, or 3. the 17th signaling event during the second MF portion of the call . . . losing the data (or the remainder of the data) on the first MF portion of the call. The 2763 stops monitoring on the 32nd signaling event during either the first or the second MF portion of the call.

4.89 DETECTING MISSING DIAL PULSES

4.90 To detect missing dial pulses, proceed as follows:

1. Connect the 2763 to line in question as described in paragraph 4.7.

2. Adjust the MIN. PULSE control for minimum setting (about 20 ms).

3. Using a manual sender, transmit a known sequence of DP signals representing all digits.

4.91 Known sequence of digits will be displayed if dial pulses (break time) are longer than the MIN. PULSE WIDTH control setting of 20 ms. Speaker provides audio output of input signals on L1 and/or L2.

4.92 While the known series of DP signals are being transmitted, missing pulses can be detected by the following observations:

1. Hearing switching sounds monitored by speaker in loop dial pulsing (E or M dial pulsing is not monitored by speaker),

2. Visual observations of OFF HOOK lamp flashing with each pulse in a series, and/or

3. Numeric display of monitored dial pulses having pulse widths longer than the MIN. PULSE WIDTH control setting. The numeric display directly reflects the pulse count of each pulse train transmitted in a known sequence of DP signaling. ID period must be >275 msec.

4.93 DETECTING SHORT DIAL PULSES

4.94 The 2763 can be used to determine if one or more pulses in a series of pulses, representing a digit, have too short a duration (pulse width, on-hook or break interval). This can be done whether or not the standard pulse width of the sending equipment is known.

4.95 When only the standard speed (pulses per second) and percent break are known, the standard pulse width can be calculated using the following pulse width formula:

$$\text{Pulse Width (ms)} = \frac{\%\ \text{Break}}{\text{Speed (pps)}} \times 10$$

4.96 To determine if the DP signaling of the digits transmitted is correct, refer to paragraph 4.91 and then perform the following steps.

1. Connect the 2763 to line in question.

2. Set MIN. PULSE WIDTH control a few milliseconds less than proper pulse width (e.g., if proper pulse width = 72 ms, set MIN. PULSE WIDTH control to 68 ms).

3. Transmit a known sequence of DP signals that represent all the digits on monitored trunk.

4.97 Known sequence of digits will be displayed if dial pulses (break time) are longer than MIN. PULSE WIDTH control setting. Speaker provides audio output of input signals on L1 and/or L2.

4.98 If the 2763 display is incorrect because one or more pulses were unacceptable to the unit, note those digits in error and proceed to investigate them individually.

4.99 Turn MIN. PULSE WIDTH control counterclockwise several milliseconds and transmit the DP signaling of a digit in question. Repeat this procedure with the same digit until the display agrees with the DP signaling. The MIN. PULSE WIDTH control setting will indicate the approximate minimum pulse width in the DP signaling of the digit transmitted (example: a 10 pps sender operating at 70 % break on a loop supervision trunk is causing the receiver to produce an occasional erroneous output). The DP signal of digit eight is being recognized by the receiver as the digit six. To diagnose this problem, proceed as follows:

1. Calculate the pulse width.

$$\text{Pulse Width} = \frac{70\ \%}{10\ \text{pps}} \times 10 = 70\ \text{ms}$$

2. Set MIN. PULSE WIDTH control to approximately 68 ms.

3. Since the DP signal for digit eight is in error, transmit several groups of eight dial pulses from the suspect sender for monitoring with the 2763.

4. Count the flashes of the OFF HOOK lamp and listen for the switching sounds from the speaker during transmission. Assume that a six was displayed while eight pulses were heard.

5. Turn MIN. PULSE WIDTH control to approximately 60 ms and transmit the same signal. Assume that a seven is displayed.

6. Turn MIN. PULSE WIDTH control counterclockwise a few more milliseconds and repeat the transmission. This is done until an eight is displayed.

7. This test has shown the approximate pulse widths to be: six pulses greater than 67 ms, seven pulses greater than 60 ms, and eight pulses greater than the last MIN. PULSE control setting.

4.100 If the standard pulse width, percent break, or sender speed is not known, the approximate minimum pulse width for a series of pulses may be determined by setting the MIN. PULSE WIDTH control to minimum setting (about 20 ms) and alternating transmission of a series of pulses in question, with clockwise adjustments of the MIN. PULSE WIDTH control. This is done until a feeling for the standard pulse width is obtained.

4.101 DIAGNOSTIC OPERATION IN TONE MF SIGNALING SYSTEMS

4.102 The 2763 is helpful in troubleshooting marginal or inoperative MF systems. The line under observation is assumed to be out of service so that a known sequence of tone pulses can be sent at machine or manual rate. Table 4—10 lists some of the typical requirements imposed on MF senders and receivers. The following paragraphs describe several techniques to diagnose MF signals. Similar troubleshooting techniques can be used to analyze DTMF signals.

4.103 DETECTING DEFICIENT MF SIGNALING . . . THE ERROR FUNCTION

4.104 The 2763 can be used to determine the quality of MF signaling. MF signal quality can deteriorate due to one or more of the following causes:

1. MF signal not composed of two and only two frequency components,

2. too short a duration of an MF tone pair,

3. excessive level difference between tones in a tone pair >15 dB in AGC . . . referred to as "twist," and/or

4. excessive time between the start of each tone in a tone pair . . . referred to as "skew."

NOTE

The 2763 will ignore all tone periods less than the MPW control setting and all tone levels less than the threshold level control setting. No errors are indicated in the display.

4.105 The ERROR FUNCTION enables the user to quickly and accurately identify MF signals with errors. When the ERROR FUNCTION is enabled, the frequency content indicators light for the duration of the tone present at the input port. Should a signal be deficient due to any one of the four given causes, the frequency content indicators are latched on and the frequency content ceases to be a real-time display.

The lighted indicators specify which signal components were satisfactory with respect to:

1. frequency bandwidth, and

2. single tone amplitude set by RECEIVE LEVEL control.

4.106 A single frequency content lighted indicator may be due to the (a) absence of the second tone, (b) a low level of the second tone, or (c) the wrong frequency of the second tone. Two frequency content lighted indicators are the result of excessive skew. More than two frequency content lighted indicators denote that the MF signal contained too many components.

4.107 In addition to latching the frequency content display, the 2763 also places an "E" on the display after detecting an error. Subsequent MF signals will either place an appropriate digit (code) or an "E" on the display. However, the frequency content display will retain the frequencies for the first error encountered.

4.108 EXAMPLE OF ERROR ANALYSIS

4.109 Suppose the 2763 presents the following information after an MF transmission:

1. 1300-Hz indicator lighted,

2. " 0EE6E6EE5E6 " appears on the display, and

3. KP and ST indicators lighted.

Assuming that the error is consistent in any one transmission, one may eliminate from consideration those frequencies present in the KP and ST codes and in digits 0, 5, and 6 (refer to Table 4—4). By deduction, the 700-Hz sender is inoperative since 700 Hz is the only frequency not a component of 0, 5, 6, KP, or ST.

4.110 Now, suppose the 2763 presents the following information:

1. 700-, 1100-, and 1300-Hz indicators lighted,

2. " 22EEE66E" appears on the display, and

3. KP indicator lighted.

Assuming a consistent error and by checking the component frequencies of the KP code and of digit 2 and 6 (refer to Table 4—4), one finds that 1100 Hz is the only frequency common to all three and that the 1100-Hz indicator is also one of the latched indicators. Therefore, the 1100-Hz sender turns on for any digit.

Table 4—10. MF Signaling Requirements.

PARAMETER	SENDER	RECEIVER
normal pulse width (for other than KP)	68 ± 7 ms	
KP pulse	100 ± 10 ms	55 ms/min
interdigital period	68 ± 7 ms	
short pulse width (note 1)		30 ms/min
short inter-digital period (note 1)	25 ms/min	
slow pulsing (2 digits/ second)		
tone on		260 ms
tone off		230 ms
fast pulsing (10 digits/sec)		
tone on		35 ms
tone off		65 ms
skew (compound, frequency tolerance)	(note 2)	6 ms
level per frequency	− 6 dBm at 0 TLP	− 22 dBm
twist		6.5 dB
frequency tolerance	F0 ± 1.5%	

NOTE:

1. Does not imply that a receiver can accept a pulse string of 30 ms tone and 25 ms no tone.

2. The two tones are applied to a trunk simultaneously and neither is transmitted if either tone source should fail.

4.111 DETECTING EXCESSIVE DIFFERENCES IN TRANSMISSION LEVELS

4.112 If particular MF signals, or groups of signals using a common frequency, fail to register correctly even on manual sending, one or more of the MF frequencies may be significantly lower than the others in amplitude.

4.113 Connect the 2763 to the line in question, as described in paragraph 4.7, and then enable the ERROR FUNCTION. Using a sender, transmit a known sequence of MF signals beginning with KP and ending with ST to include all digits. If the expected display for the known sequence of MF if an error, excessive transmission level differences may be present. That is, the amplitude difference between the frequency components may exceed 6 dB or more.

4.114 Set the MIN. PULSE WIDTH control at its minimum setting (20 ms) to eliminate pulse width as a contributing factor. Set the RECEIVE LEVEL control at its minimum setting (− 26 dBm). Repeatedly transmit "KP1234567890ST" each time adjusting the RECEIVE LEVEL control slightly to increase the threshold level until an error appears on the display. At this point, the RECEIVE LEVEL control setting is slightly above the component with the lowest amplitude and the frequency content display showing the frequency of the component whose amplitude exceeds the RECEIVE LEVEL control setting. Analysis of the displayed data (refer to paragraph 4.108) reveals the frequency component whose amplitude is less than the RECEIVE LEVEL control setting. For example:

1. RECEIVE LEVEL control set at − 20 dBm,

2. 900-Hz indicator lighted,

3. " EE3E56E890 " appears on the display, and

4. KP and ST indicators lighted.

Assuming that the correct display was obtained with the RECEIVE LEVEL control set at − 21 dBm, we can conclude that the 700-Hz component has an amplitude of about − 21 dBm.

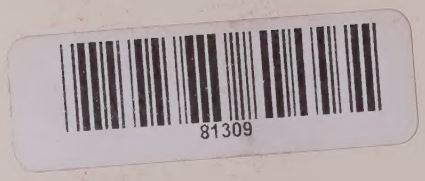
4.115 Now, repeatedly transmit KP, a digit which had an error, and ST. For the previous example, we could transmit "KP1ST", "KP2ST", "KP4ST", or "KP7ST". Each time adjust the RECEIVE LEVEL control to increase the threshold. Continue until the 2763 fails to detect both components of the transmitted digit or fails to detect the KP code. If the difference between the RECEIVE LEVEL control setting now and setting when the first error was detected is greater than 6 to 8 dB, then the transmitted digit has excessive twist.

4.116 DETECTING SHORT MF PULSES (MACHINE SENT)

4.117 If MF signaling errors are noted on machine-pulsed numbers, but not on manually pulsed numbers from the same MF sources, too short a pulse width may be the cause. The 2763 can be used to determine if short pulses are being sent or received. Since channel distortion is possible, a valid transmitted signal from office A does not guarantee a valid received signal at office B, however. Both ends of the circuit should be checked.

4.118 To check for short MF pulses and/or the approximate length of any MF signal pulses, proceed as follows.

Connect the 2763 to one end of the line in question as directed in paragraph 4.7. Set the RECEIVE LEVEL control at its minimum setting to eliminate level as a contributing factor. Transmit a known sequence of MF signals representing all digits from the suspected sender. Any signal having a pulse width shorter than the setting of MIN. PULSE WIDTH control will not be decoded and displayed. Repeat the transmission several times, each time adjusting the MIN. PULSE WIDTH control clockwise by a small increment. This increases the minimum pulse width required by the instrument for display of any MF signal. In this manner the approximate pulse width of each digit sent can be determined.



northeast electronics
DIVISION OF tau-tron inc.
A UNIT OF GENERAL SIGNAL

57 Regional Drive P.O. Box 2021 Concord, N.H. 03301
1-603-228-3700 1-800-222-4124 (Outside N.H.)